DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

JUNE, 1942

There is no war production industry that is of greater importance in winning the war than the aircraft industry. July MACHINERY, the Annual Aircraft Number, therefore, deals with a subject of national importance. It will cover the most recent advances in mechanical practice as exemplified in aircraft plants from coast to coast. A great many phases of the manufacture of both engines and planes will be dealt with in the articles covering the manufacture of this all-important equipment for victory.

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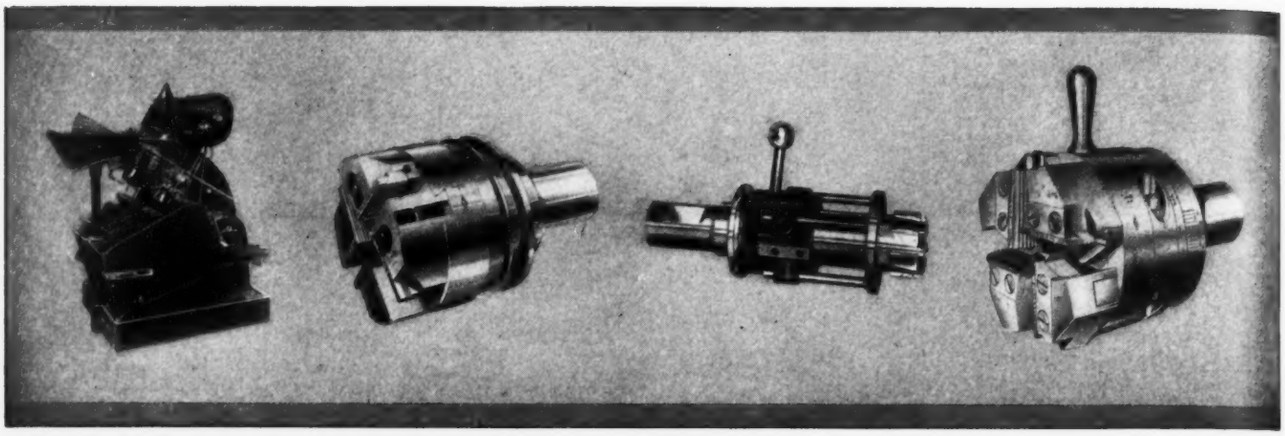

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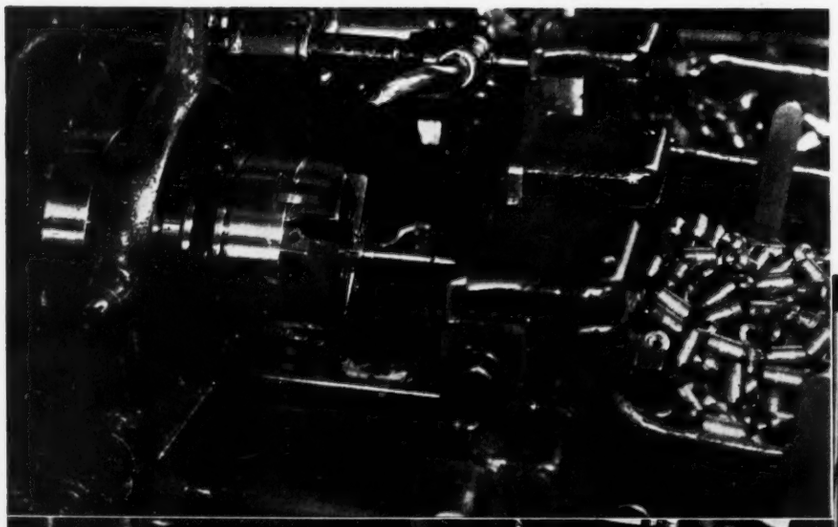

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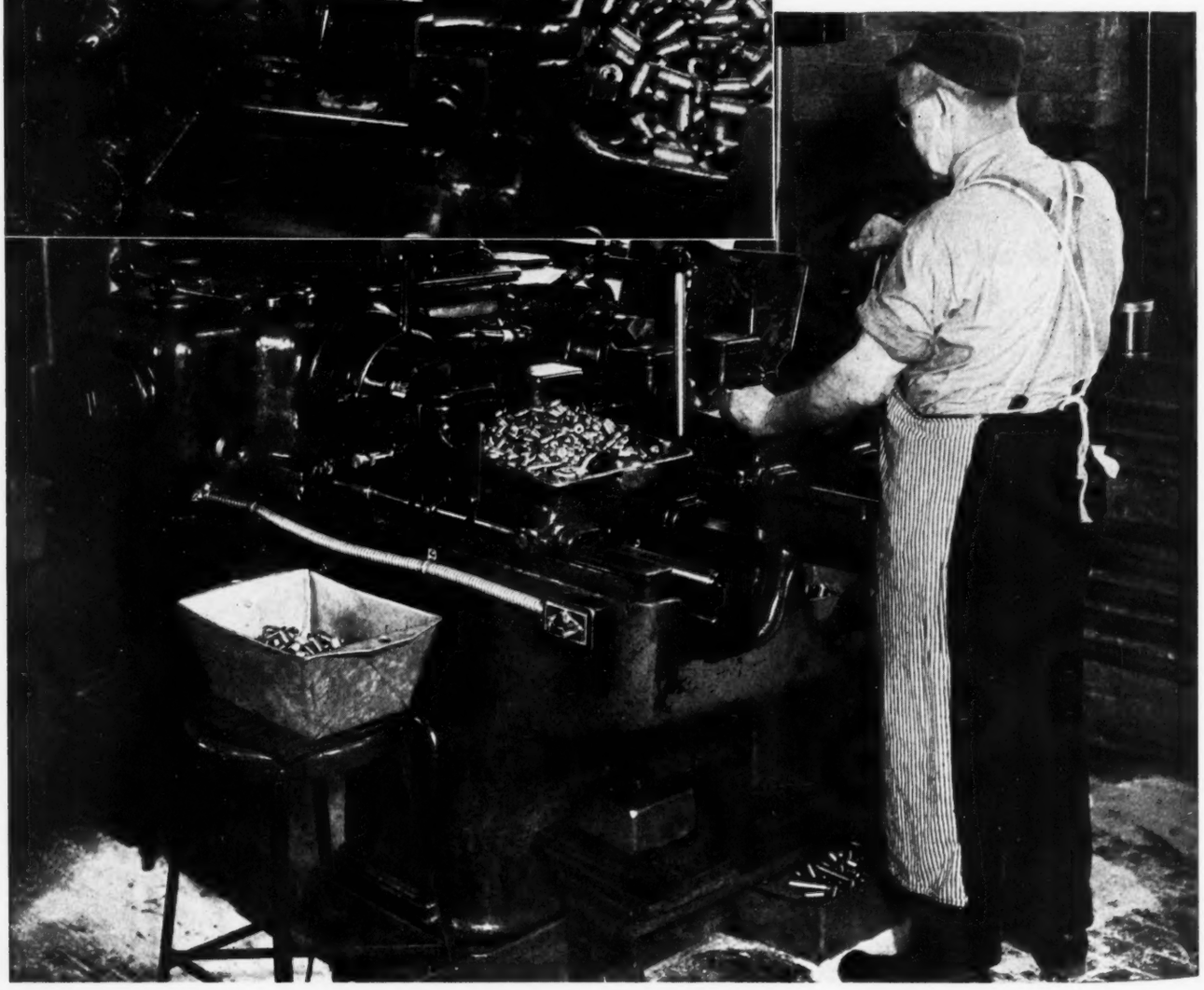

MACHINERY

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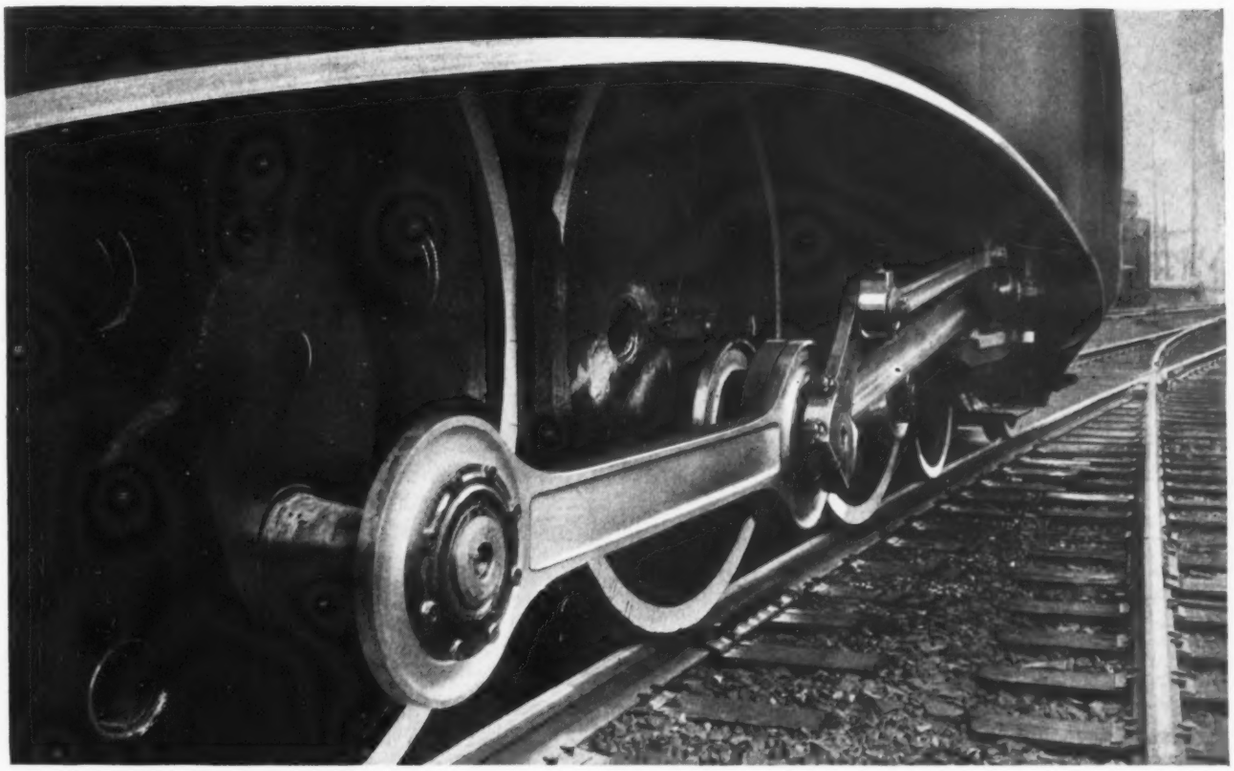

"High Dynamic" Steel Parts for Locomotives

Operations in Machining Light-Weight Reciprocating Parts for High-Speed Engines Equipped with Roller Bearings

By WALTER C. SANDERS
General Manager, Railway Division
The Timken Roller Bearing Co.

★

WITH the increased speed of locomotives made possible by the application of roller bearings, it became desirable to reduce the weight of the reciprocating parts, that is, the piston, piston-rod, cross-head, and front half of the main rod. This was important, because at a speed of 100 miles an hour, a mass approximating that of an ordinary automobile must be started and stopped twelve times every second. It is necessary to counterbalance this mass, for otherwise, the blows developed at high speeds would destroy the railroad tracks and bridges and damage the mechanism of the locomotive.

To reduce this problem, the Timken Roller Bearing Co. developed light-weight main- and

Fig. 1. Machining One End of a Large Driving-axle Bearing Housing for a Locomotive within Close Concentricity Relative to the Opposite End of the Housing

side-rods and other reciprocating parts that are made from "High Dynamic" steel. As a result, the weight of the reciprocating parts for the average engine has been almost cut in half—or to about 1200 pounds per locomotive side, as against 2200 pounds on engines equipped in the conventional manner. Typical operations in producing these light-weight reciprocating parts, as well as bearings and bearing housings for locomotives, are described in the following.

The machining of locomotive driving-axle bearing housings and boxes calls for a high degree of accuracy, both as to diameter and to alignment of the bores at opposite ends of the steel casting. For example, on a housing 4 1/2 feet in length, the alignment of the bores must be true within 0.002 inch. Diameters must be as specified within plus 0.002 inch, minus nothing. Boring of the housings is performed in engine lathes, with one end of the housings accurately located on a fixture mounted on the lathe faceplate, and the other end held in a large steady-rest, as shown in Fig. 1. Eight different cutters are required for the boring and facing cuts on each end. The operator uses a hand mirror to observe the tool during some of the cuts.

Guides to fit the frames of locomotives are milled on the sides of the driving-axle bearing housings by employing the Milwaukee duplex milling machine shown in Fig. 5. For this operation, a finished circular registry surface on the housing is located on a fixture on the machine table, so that the opposite guides will be milled equal distances from the center of the bore.

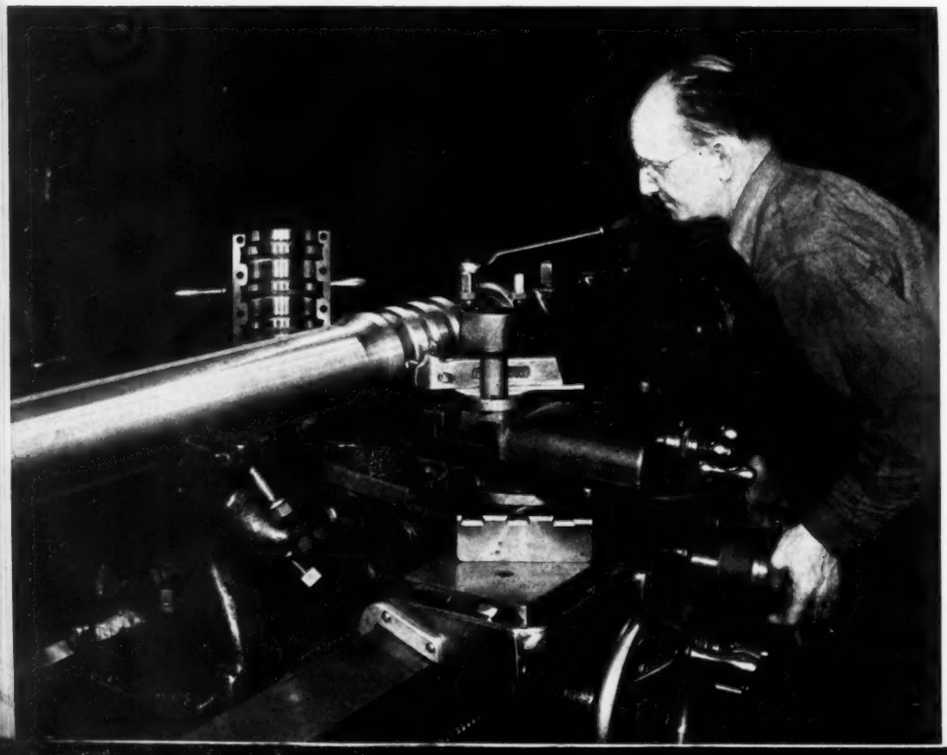

Fig. 2. Turning Annular Locking Keys on the End of a Piston-rod, which are then Scraped and Polished to Fit the "Bluing" Gage Seen at the Back of the Cross-slide

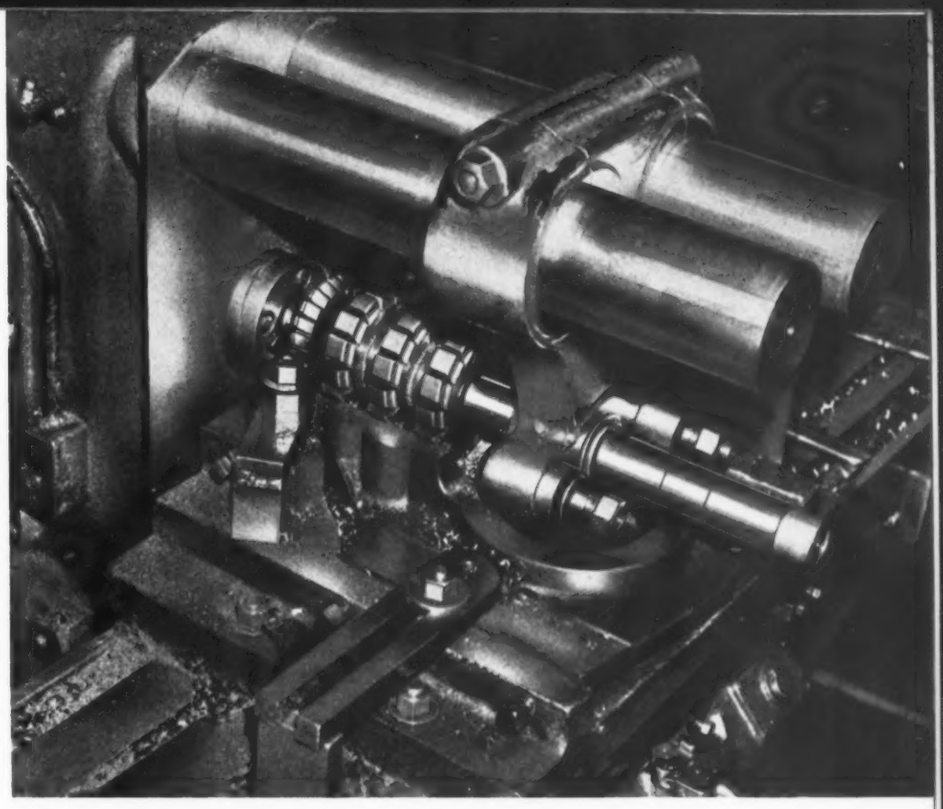

Fig. 3. Employing Four Formed Cutters Simultaneously for Milling Locking Grooves in the Cross-head Halves to Fit the Annular Keys on the Piston-rods

These dimensions must be held to within plus or minus 0.0025 inch. The distance from one guide to the other must be within limits of plus or minus 0.005 inch.

All three surfaces of each guide are being milled at one time in the operation shown, the height of the guides being held to a fractional dimension only. The cutters are 8 5/16 inches in diameter, and are of the inserted-blade type. The locomotive driving-axle housing seen on the milling machine has a finished weight of 1468 pounds, including liners, bolts, etc.

Two of the most important operations in the production of the light-weight reciprocating parts are the turning of annular locking keys on one end of the hollow piston-rods and the milling of corresponding grooves in the two halves of the cross-heads. Fig. 2 shows the key-turning operation being performed on a Le-Blond engine lathe after the piston-rod has been rough- and finish-turned for its complete length.

The locking keys are turned and then polished in the lathe with emery cloth until the sides closely fit the profile gage seen on the carriage. All six sides of the annular keys must fit the gaging surfaces of the profile gage without any light showing. Then the half-bearing type of gage seen at the rear of the cross-slide is covered with Prussian blue and carefully fitted to the locking keys by tapping it with a lead hammer. High spots that show up on the keys after this gage has been removed are polished away.

The corresponding locking grooves in each

Fig. 4. Cylindrical Grinding Machine which is Employed to Finish the Body and Tapered Piston Fit of the Hollow Piston-rods to a High Degree of Accuracy

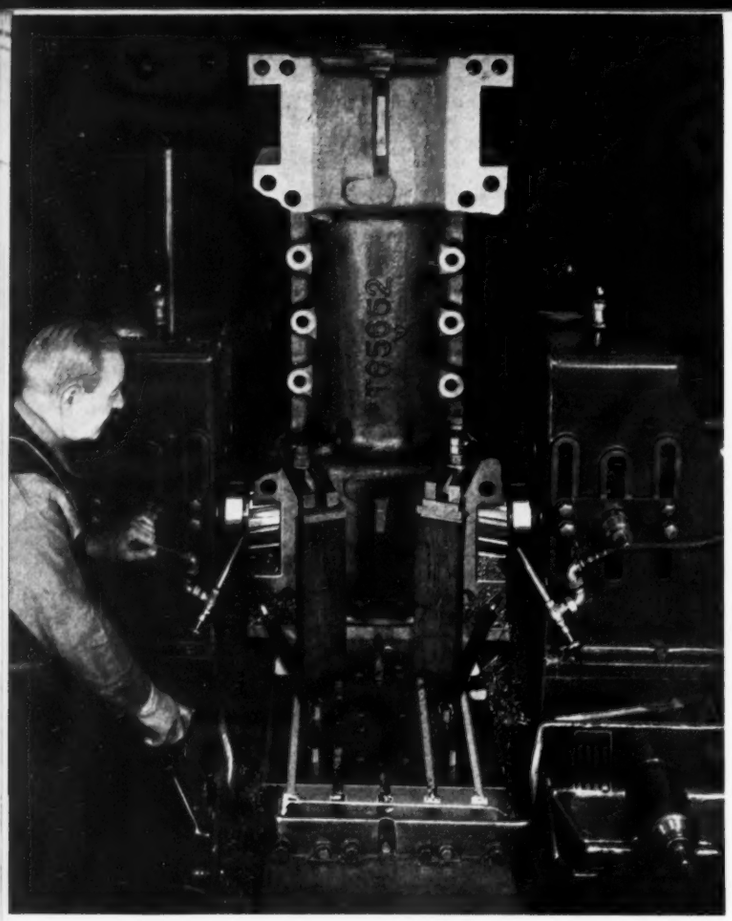

Fig. 5. Simultaneously Machining Guides on Opposite Sides of a Driving-axle Bearing Housing within Close Dimensional Limits Relative to the Center Line of the Bore

cross-head half are milled on a Milwaukee milling machine set up as illustrated in Fig. 3. Four formed cutters, mounted on an arbor, simultaneously mill all grooves as the work is fed upward into the cutters. After being milled, the locking grooves are carefully scraped and polished to a plug type of "bluing" gage, so as to insure interchangeability with the locking keys on the piston-rods.

The hollow piston-rods are ground along the body and on the tapered piston fit in the Norton cylindrical grinding machine shown in Fig. 4. As the piston-rod fit must "blue up" with the piston bore, it is ground to extreme accuracy and checked by a ring gage. The taper portion of the piston-rod has been turned on a lathe equipped with a taper attachment when it reaches the grinding machine. When the taper is ground, the table of the grinding machine is adjusted to suit.

The body diameter of the piston-rod is held to size within 0.004 inch, even though this surface is not a fit in any part. About 0.025 inch of stock on the diameter is ground off. For this grinding operation, which is performed with the work supported on centers, the headstock end of the piston-rod is fitted temporarily with a centered plug. The tailstock end of the rod is supported on a centered plug which has been permanently assembled in the work-piece.

Grooves are being turned around a "High Dynamic" steel piston by the American engine lathe shown in Fig. 6. The grooves are square, with a half-round depression, or second groove, in the middle of their bottom surfaces. The width of the square grooves is held to between 0.875 and 0.878 inch, and the height of these grooves must be maintained within plus nothing, minus 0.005 inch. The piston shown is 24 7/8 inches outside diameter.

A wide tool is used in roughing out the square grooves from solid stock, and then narrow tools are employed for finishing the sides of these grooves independently of each other. Roughing and finishing tools of round-nose style are next

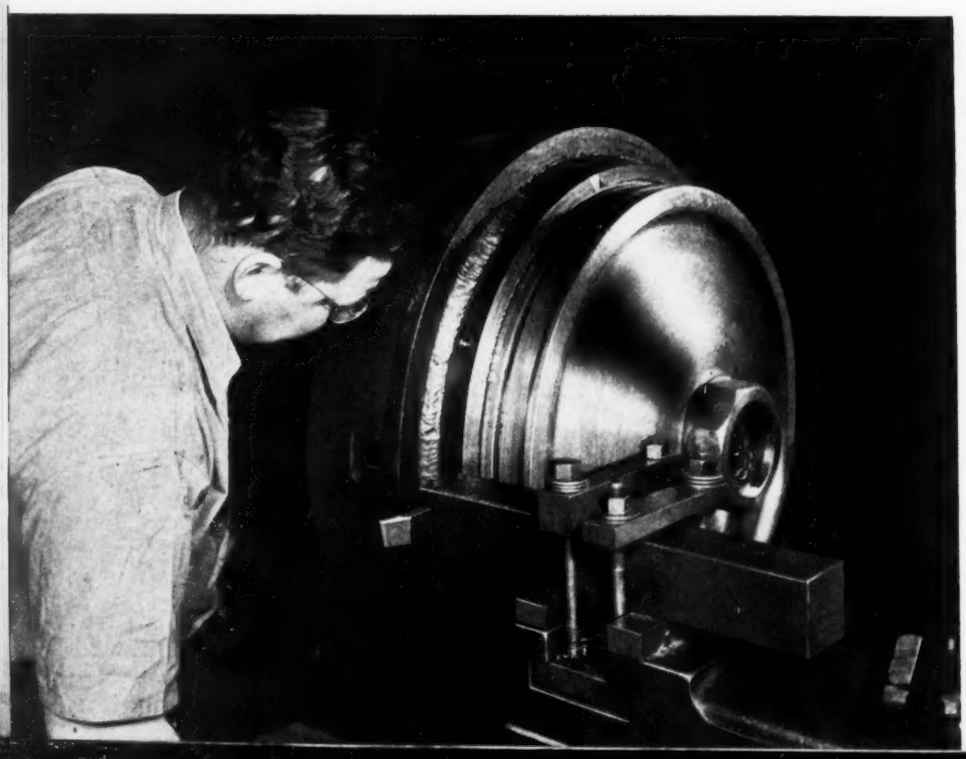

Fig. 6. Turning Packing Ring Grooves to a Close Tolerance in a Locomotive Piston Forged from "High Dynamic" Steel

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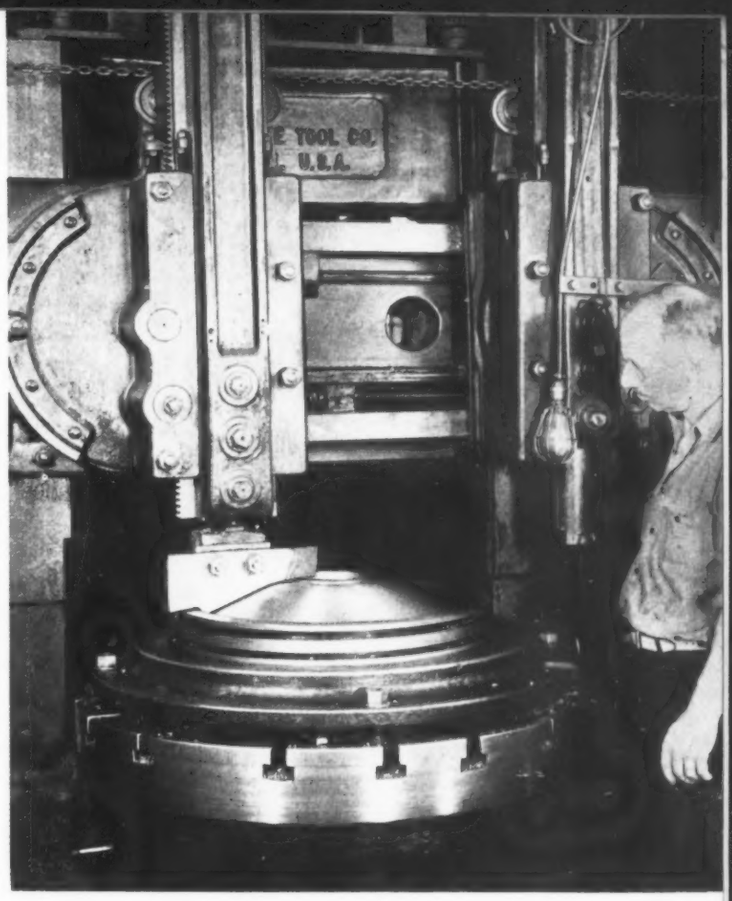

Fig. 7. Boring Mill Operation on a Locomotive Piston in which a Long Form Cutter is Used to Finish the Irregular Contour on the Front Face of the Piston

employed for producing the half-round grooves at the bottom of the square grooves.

The irregular contour on the front face of this piston is seen being finished in Fig. 7 on a King vertical boring mill equipped with a long form cutter that extends from the bore of the piston to its outer rim. Sometimes these pistons are also turned and grooved on machines of this type.

The irregular face is rough-machined by an ordinary single-point tool. A pencil outline of the irregular face is drawn to full scale on heavy paper, and the drawing is tacked to a board adjacent to the right-hand end of the cross-rail. Extending toward this end of the machine from the right-hand tool ram is a flat bar provided with a pointer. During the cut, the ram adjustments are so manipulated by the operator as to keep the pointer following the pencil line as closely as possible, with the result that a corresponding contour is machined on the piston. A smooth finished surface is obtained when the form cutter is applied to take a light shaving cut, after which the surface is polished.

Mention has already been made of the "cross-head halves." A split cross-head construction, together with annular locking keys between the cross-head and piston-rod, was developed in order to eliminate the key that passes through the cross-head and piston-rod in conventional cross-head designs and is sometimes a point of failure on locomotives in service.

The entire manufacturing procedure on the cross-heads is tooled up in a way to insure interchangeability of all parts involved. In all operations after the piston-rod fit has been bored, the cross-head halves are located in fixtures from dummy piston-rods, which consist of half-round plugs, somewhat shorter than the piston-rod bore in the cross-head halves. These dummies are of the same diameters as the piston-rod bore. They are fitted with a key that mates with a groove in the fixture.

This method of locating the work will be apparent from Fig. 8, which shows an operation

Fig. 8. Shaping Shoe Face on a Cross-head Half with Part Located from Piston Bore by a Dummy Piston

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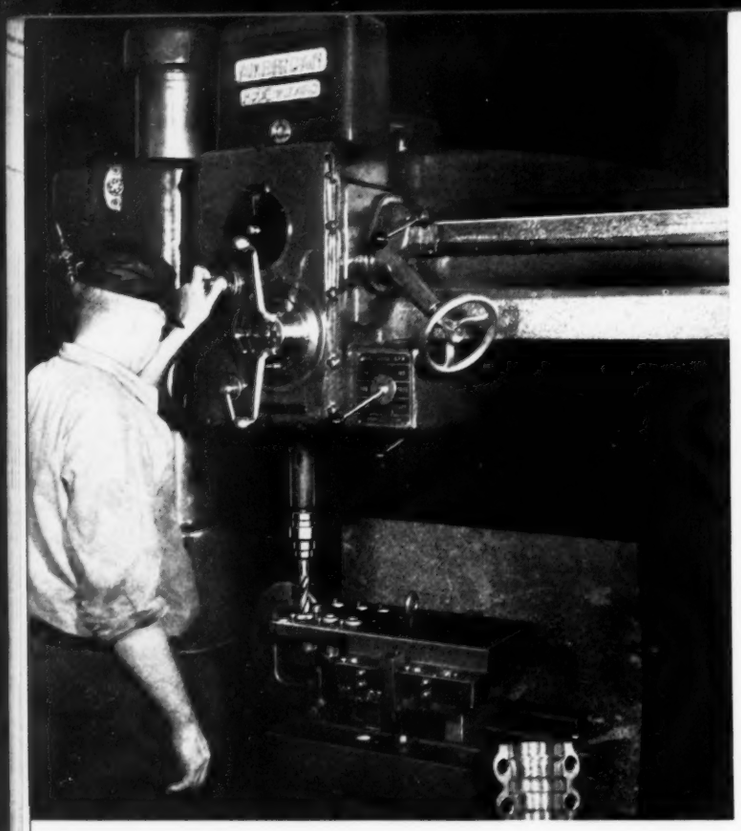

Fig. 9. Radial Drilling Machine Used in Drilling and Reaming the Body and Shoe Bolt-holes in Cross-head Halves in Accurate Relation to Each Other and to the Piston-rod Bore

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Fig. 10. Vertical Boring Machine Provided with an Independent Motor-driven Grinding Head for Finishing the Cross-bore of Cross-head Halves after They have been Rough- and Finish-bored on the Same Machine

on a Smith & Mills shaper. The use of the dummy piston-rods insures that all important surfaces on the cross-heads will be machined parallel or at right angles to the piston-rod bore.

In the operation illustrated, the shoe face on one side of a cross-head half is being finished. The height of this surface above the center line of the piston bore must be as specified within a tolerance of 0.001 inch. Both sides of the cross-head halves are machined in the same set-up.

The cross-head halves are set up in similar manner for the operation shown in Fig. 9, which consists of drilling and reaming six body bolt-holes and eight shoe bolt-holes. When reamed, these holes must be between 1.0000 and 1.0006 inch in diameter. Slip bushings are employed in the jig plate, which is clamped to the cross-head after it has been located on the jig. All bolt-holes must be closely parallel in relation to each other, as well as accurately located with respect to the piston-rod bore. The operation is being performed on an American radial drilling machine.

Another important operation on the cross-head halves consists of boring and grinding the cross-bore to receive a Timken tapered roller bearing. This is done on a King vertical boring mill equipped as shown in Fig. 10. The bore is rough- and finish-machined with the work clamped as shown. But for grinding, it is mounted on a separate fixture, with the piston-rod fit located on a dummy piston-rod in the manner already explained. A Dumore grinding attachment, mounted on the left-hand tool ram as shown, is used in grinding the cross-bore to size within a tolerance of 0.001 inch. The cross-bore diameter on the part shown is 7.376 to 7.377 inches.

Aluminum guide shoes or "slippers" for cross-heads are being finished in Fig. 12 on a Cleveland open-side planer. Three shoes, 30 inches long by 9 11/16 inches wide, were on the planer at the time the photograph was taken. All surfaces of the channel-like cross-section, with the exception of the bottom side, are machined in one set-up, the square-nose tool being used for the entire operation.

Cast-steel spring seats are hollow-milled and bored simultaneously on a Fosdick radial drilling machine, as illustrated in Fig. 11. These castings are of a double construction having two bosses that are hollow-milled, one at a time, to 2 5/8 inches diameter. As the boss is being hollow-milled, the flanges surrounding that boss are simultaneously bored to a diameter of 7 3/8 inches. The bosses and flanges are 1 1/2 inches high.

The casting is placed in a fixture provided with a sliding plate that is fitted with a large guide bushing that is engaged by the pilot seen just above the boring cutter. This bushing plate

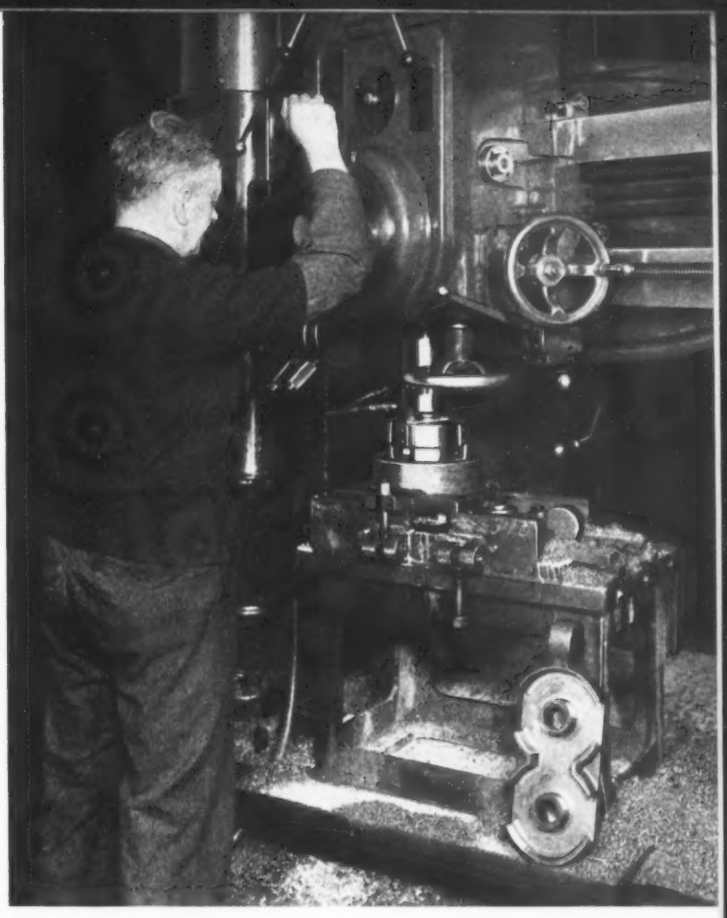

Fig. 11. Combination Hollow Milling and Boring Operation which is Performed on Both Ends of Cast-steel Spring Seats

can be located at both ends of the fixture, as required in machining opposite ends of the casting. Dowel-pins are slipped through holes in the bushing plate and in the fixture to insure proper location, and swinging bolts are then employed to clamp the bushing plate into place. Both the hollow mill and the boring head are provided with four inserted cutter blades.

* * *

Bullard Co. Makes Remarkable Savings by Reclamation Program

At a recent conference on industrial salvage, held by the American Society of Mechanical Engineers in New York, Robinson D. Bullard, reclamation engineer for the Bullard Co., of Bridgeport, Conn., related some interesting facts concerning his firm's reclamation program, which is estimated to have resulted in saving the nation's transportation system the use of 250 freight cars a year.

The Bullard Co. is saving 25,000 gallons of cutting and lubricating oils a year, as well as 125,000 pounds of cotton and wool waste, and its briquetting plant is handling 15,000,000 pounds of iron borings and steel turnings for remelting. Through the careful handling and systematic routing of borings and turnings, the company recovers about 35,000 pounds of chromium, and 75,000 pounds of nickel a year.

Reclamation at the Bullard plant also extends to cutting tools. Tools that become worn are first reconditioned for use in the plant, and if reconditioning is not possible, the tools are catalogued for the benefit of other manufacturers whose work may not call for the fine tolerances required in the production of machine tools.

* * *

Silver-faced steel is highly resistant to galling when in sliding contact with steel surfaces, and is used in some aircraft engine bearings subjected to high bearing pressures.

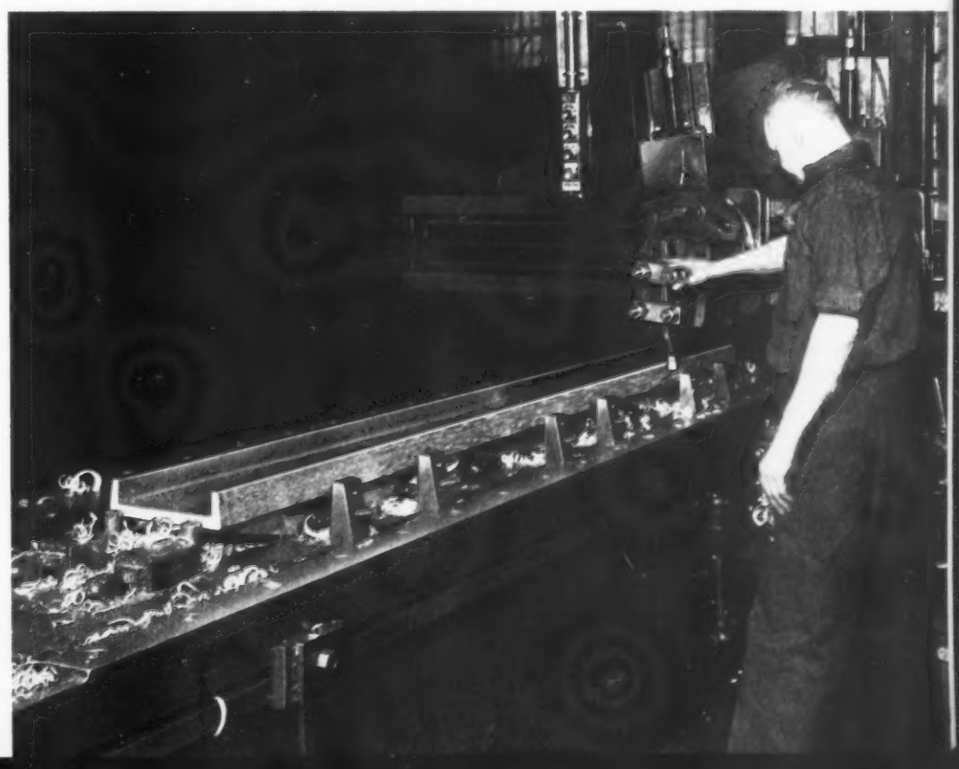

Fig. 12. Planing Aluminum Guide Shoes for Cross-heads on an Open-side Planer. Three Pieces are Machined in One Set-up

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Faster Welding Through the Use of Larger Electrodes

ACCORDING to information obtained from the Lincoln Electric Co., Cleveland, Ohio, the use of larger electrodes is saving much time in many plants throughout the country. Thus, for example, the Stevens Metal Products Co., Niles, Ohio, reports: "The most outstanding example we can offer on the use of larger electrodes is on one of our products where we are making a fillet weld joining 16-gage to 1/4-inch steel. We formerly used 1/8-inch diameter rod with a current of 90 amperes and a welding speed of 7 inches per minute. Changing to 5/32-inch electrodes, the current was increased to 170 amperes and the welding speed to 16 inches per minute."

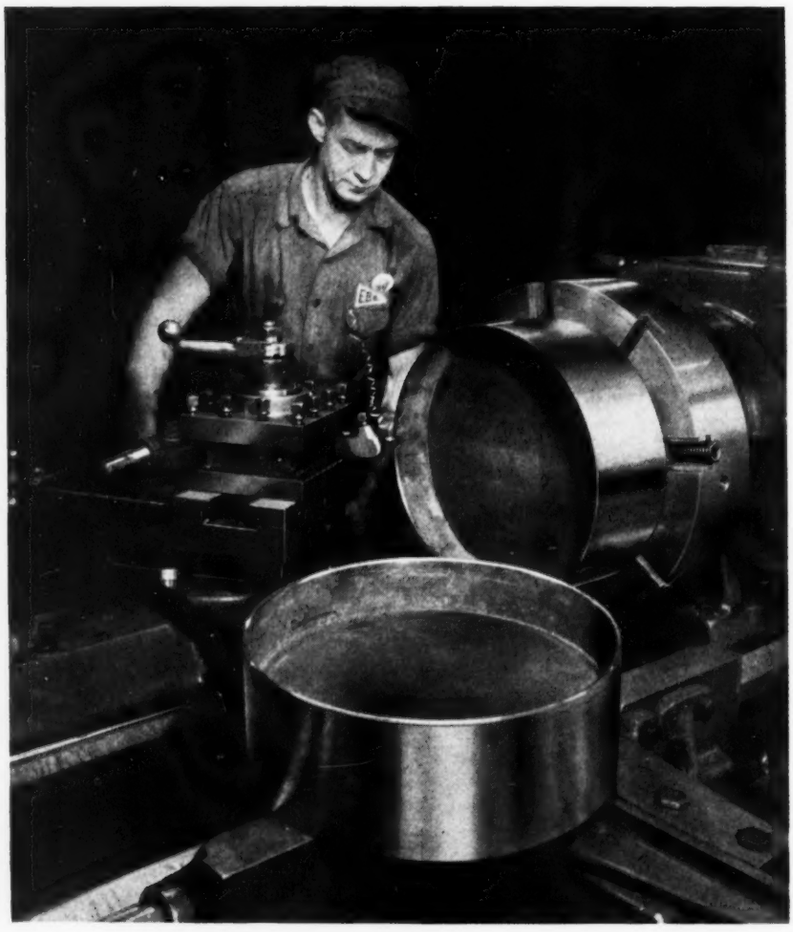
The St. Paul Structural Steel Co., St. Paul, Minn., states: "Using a 5/32-inch electrode in three passes, we made about 72 inches of 1/4-inch fillet welds in approximately 90 minutes. Using a 5/16-inch electrode in one pass, we make the same weld in approximately 30 minutes. We are saving about 45 man-hours per week on this one item."

Another example is furnished by the Downingtown Iron Works, Downingtown, Pa., who record their experience in this manner: "Recently we had an order on which the average time was 4 to 4 1/2 hours using 5/32-inch and 7/32-inch electrodes. On more recent orders for the same work, the time is between 3 1/4 and 3 1/2 hours by the use of 3/16-inch and 1/4-inch rods."

* * *

New Magnesium Fire Extinguisher

A new powder known by the trade name "Magout" has been developed by the Pulmosan Safety Equipment Corporation, 176 Johnson St., Brooklyn, N. Y., for easily and quickly extinguishing magnesium fires. It is said that this powder instantly smothers fires caused by magnesium shavings in machine shops or by magnesium incendiary bombs. It is a non-absorbent, finely pulverized dry powder, safe to handle and easy to use.



Turning Steel Periscope Wells for Submarines. The Periphery of These Wells is 16 1/2 Inches in Diameter, and the Face Width About 6 Inches. The Lathe Used for This Operation was Built by the American Tool Works Co.

VICTORY

Training Operators in a Plant Converted to War Work

Outline of a System by which a Nationally Known Manufacturing Organization has Trained Its Regular Employes, Ordinarily Engaged in Making Linoleum, Bottle Caps, Plastics, and Gaskets, to Produce Precision Metal War Products

THIS article records the experience and "training for war work" methods used by a company that owns a dozen plants throughout the country, the principal one of which manufactures linoleum, while others make bottle caps, plastic products, and gaskets. This company has been successfully training men who have never previously done machine shop work to operate equipment necessary in the manufacture of war material. The methods used are recorded here for the benefit of other manufacturers who are contemplating conversion of their facilities to war production.

In handling this training program, it has been the policy of the company to train its regular employes who may have been engaged in linoleum manufacture, bottle cap, or plastics production, etc., to do machine shop munitions work, so that the men who have been with the company for many years will be assured of a job, should it become necessary to more and more curtail the regular manufacture of peacetime products.

To the extent that the manufacture of peacetime products is still carried on, new men from the outside are hired and trained for that work. In that way, as the amount of peacetime work diminishes, if it becomes necessary to lay off men, it will be the recently hired workers who will be laid off, and not the men who have been identified with the company for a number of years. The company feels that it is one of its duties to provide its workers with permanent work in their home locations, and considers this principle in the training program one of the important points that every concern should take into account.

Workers Must be Impressed with the Importance of Munitions Manufacture

The next step is to impress upon the workers the importance of munitions manufacture, not only to the country, as an essential to winning the war, but to the company itself, as a means of tiding over the emergency period. All problems concerning the relation of the men to the munitions program are discussed with them. It is explained that by being trained for munitions work, they are more likely to assure themselves of permanent employment, whereas, otherwise, when the production of peacetime products is curtailed, they would have to be laid off from their regular work.

To carry out the munitions contracts that have been obtained by the company, it has been found necessary to train men in welding, sheet-metal work, machine tool operation, and, generally speaking, in all ordinary classes of metal fabrication. When the company receives a contract, men are trained immediately, so that no time is wasted in finding employes capable of doing the work.

First Step is to Train the Supervisors

In the case of a plant that is being turned over to metal-working from an entirely different peacetime product, the engineers and supervisors must first study the best methods of doing the work, and then the best methods of teaching workers how to do it. In order to train supervisors on aircraft work, for example, these men were sent to an aircraft factory to work until they really knew how the work was performed and could perform it themselves.

In a sense, the foremen were actually "apprenticed" in an aircraft plant to learn the business; then, upon their return, they taught the procedure to the workers. A great many manufacturers who have converted their plants to munitions work have made a mistake at this initial point—they have not seen to it that their foremen were properly trained in how to do the work and in how to teach others to do it.

In the organization of training courses for workers who have not previously been engaged in metal-working, the public school system has cooperated with the company, in many instances, by providing instructors. For example, in the welding classes, the public school authorities provided two instructors, while the company

WAR PRODUCTION PRACTICE

The First Step is to Teach the Men How to Read Blueprints. They are Taught the Methods of Representing Parts on Detail Drawings

VICTORY

Tool Grinding Practice is being Thoroughly Taught to Those who Have to Do This Work. Note that the Men are Protected by Masks

VICTORY

The Tools and Methods Used in Stamping Aluminum Parts on a Large Hydraulic Press are Explained to the Machine Operating Class by an Instructor

Oxy-hydrogen Welding of Aluminum Plate is being Taught to the Student by having Him Do the Work while the Instructor Watches Him

VICTORY

Instructing a Class in Spot Welding. The Men being Trained are Locating an Aluminum Part between the Jaws of a Spot-welding Machine

VICTORY

Instruction in Arc Welding Has an Important Place in the Training Program, as Arc Welding Enters Largely into the Production of War Materials

WAR PRODUCTION PRACTICE

Bench and Assembling Operations are Taught to Men with No Previous Machine Shop Experience. This Work Includes the Application of Portable Electric Drills and Reamers and Similar Hand Tools

Riveting Operations are Taught to Men who will Specialize in That Work along the Production Line. As Far as Possible, Each Group of Men is Taught Only One Operation, but They are Shown how to Perform it Correctly

Another Group of Men is Taught how to Anodize Metal Parts. One Student, Protected by Rubber Gloves and a Rubber Apron and Mask, is Seen Lowering the Parts into the Tank while the Instructor, at the Extreme Left, Watches Him

furnished the facilities and material required in the training work. As mentioned, the training was started so that men capable of doing welding work would be available as soon as work on the contract could begin; and the men trained were the company's regular employes. Instruction was given three times a week, three hours each time, the men attending on their own time. In all, approximately 80 hours of instruction is given in arc welding.

The length of the training course for foremen and experienced employes who were sent to other plants for training was usually from three to four weeks. In those plants, they were taught press work, forming, riveting, and welding. About fifteen men were so trained to be supervisors on munitions work of that character. On their return, they became the teachers of workers who specialize on this kind of work.

Night classes have been organized to teach riveting; wing tip assembly; forming; spot and seam welding; oxy-hydrogen welding; lay-out, shearing, and press work; inspection; heat-treatment; templets; and blueprint reading. As the regular peacetime production is reduced, these men are absorbed in the munitions work. While they are receiving the school training, they continue with their regular work, and are ready for their new duties whenever they are needed.

The men being trained have responded remarkably well. The attendance record has been exceptionally high. Since the company works many of its regular plant operations on three shifts, it has been necessary to so time the training periods that the men would be able to work on their shift and yet be free to attend the training classes when off duty. The important thing is that these men learn by doing.

Classes in Tool Grinding and Machine Tool Operation

One of the courses provided is tool grinding. This is intended chiefly for men employed in shell manufacture. The foremen of the company's regular tool grinding department and skilled tool-room men act as instructors. Two classes are currently maintained in this subject.

When it comes to training men for regular machine tool operation — as, for example, in manufacturing shells—the training is done directly on the job. A careful operation procedure has been developed, and the men receive complete written instructions. Every machine has a special instruction sheet applying to the operations performed on it. Each learner is taught simply to operate one type of machine.

In addition to being taught how to operate the machine, these men are given instruction in the care of cutting tools and gages, in the safe operation of machine tools, and in their general responsibilities in connection with work of this kind.

Preliminary to the training on the job, an introductory evening course (three hours a night) is given in the general principles of machining, shell turning, gaging, etc. In that way, men who have never had any previous machine shop experience will have a general idea of the work to be performed. Some men are also sent to the trade evening schools; and in cooperation with the public school system, men are made ready for the job by such preliminary training. Hence, men who may have been workers in the linoleum plant are not wholly unfamiliar with the operation of machine tools when they enter a shell shop. At least, they have seen how metal is cut and how the machine tools are operated in general shop practice.

Importance of Teaching the Supervisors How to Instruct

An important part of the whole training program is that the men who are to instruct other men must be taught how to instruct. For that purpose, the regular course of the Training Within Industry Group of the War Production Board is being used, and about 500 men are taking this course. These are the men who are responsible for breaking in new operators, and include the general supervisors, foremen, and some of the best operators. Every supervisor in the company's plants will ultimately take this course, which covers ten hours, and is given by men under the direction of the War Production Board.

In addition to this specific training for munitions work, the company maintains general supervisory training and has a regular plant conference program. The supervisors meet once every three weeks. A program is prepared based upon subjects that the supervisors themselves wish to discuss. Among the subjects taken up are records of employe performance, employe attitude, merit rating for supervisors, job efficiency, etc.

For new supervisors, the company also maintains a production management course to supplement the "training on the job" instruction. Each employe taking this course receives one week of training in the particular plant in which he happens to be employed, and then spends a similar amount of time in training at the company's main plant. During this time, new supervisors study courses including elements of industrial engineering, standard costs, cost control, fundamentals of supervision, and other basic principles of management, all of which are designed to bring them up to date with the current supervisor's training program.

In conclusion, it should be said that much of the success attained by this company in handling munitions contracts to the satisfaction of both the Army and Navy Ordnance Offices is ascribed in no small measure to the careful and systematic training given the men who are doing this kind of work.

Thorough Training of Workers is Necessary in Converting to War Production

Any manufacturer planning to obtain war contracts for equipment foreign to the line of manufacture in which he is regularly engaged must recognize that the training of the employes is one of the most important steps to be taken. Without such training, it is likely that he will meet with many difficulties that might otherwise have been avoided. In fact, the difference between success and failure is to a large extent dependent upon adequate preliminary training of workers for war work.

The expression "conversion to war work" is loosely used, both by Government officials and by the public generally, without any realization of what is involved when a plant formerly engaged in a non metal-working line of manufacture turns its working force and its facilities over to munitions work.

The company whose practice has been outlined had an advantage that many similar plants do not have. It regularly maintains quite an extensive machine shop in which it builds and repairs its own manufacturing machinery and equipment, and makes the tools, dies, and other auxiliary equipment used in its various plants. It was therefore possible to build its entire munitions program around the nucleus of highly skilled engineers, supervisors, and workers engaged in this part of the company's work.

Wright Aeronautical Plan for Salvaging Materials

THOUSANDS of tons of scrap from steel, aluminum, and other materials used in the manufacture of aircraft engines at the plant of the Wright Aeronautical Corporation are being salvaged in such a condition that they can be quickly re-used in the manufacture of war products. The Wright company is said to be the first organization in the aviation field to develop a complete program of salvage control.

This system — evolved during the last few months—has the advantage of segregating the various metals as fast as they are removed in the form of chips from forgings and castings. All machine tools in the Wright plants have bins attached to them which catch and hold the shavings and chips or whatever metal waste is produced in the fabricating operations.

Salvage collectors wheel large boxes up and down the factory aisles, a single kind of metal scrap being collected in each box. To make sure that no mixing of the metals occurs, the containers, as well as the machine tools, are identified by a color-marking system. Each container is marked with a specific color combination for the metal it is to handle in the form of a large "V" painted on the side of the box. Every machine tool producing this type of scrap is tagged with a card on which is painted a "V" in identical colors. Thus a worker collecting chips from a certain alloy steel, which is identified by a green and yellow "V," gathers the shavings and chips from every machine tool that bears a card having a green and yellow "V," and collectors gathering, say, aluminum alloy stop at machines with cards bearing a yellow "V."

Although steel, aluminum, and magnesium are the principal metals salvaged, the list also includes copper, beryllium bronze, phosphor bronze, aluminum bronze, brass, and many other metals. Throughout the plants, full cooperation has been obtained from the workmen in keeping the metals separated, so that one metal will not be rendered useless for salvage by being mixed with another. Special monitors are assigned to maintain a close check on adherence to the rules for salvage procedure.

In an effort to find a use and a user for everything, the Wright Aeronautical Corporation is also saving and utilizing such things as paint pails, 5-gallon tins, empty oil drums, old rags, burlap bags, cardboard and paper, used files, old grinding wheels, barrels, and nail kegs. Waste paper, cardboard, and old rags are salvaged at the rate of 2 tons or more per day.

Used drills and other tools no longer suitable for the exacting requirements of aircraft-engine building have been found to be useful to other firms engaged in war production where the requirements are not so exacting. When broken and dulled beyond reclamation, the cutting tools may be salvaged for the steel maker.

From all of the Wright plants, scrap moves

A Mountain of Scrap Metal — All Magnesium — from the Machine Shops of Wright Aeronautical Corporation, Ready for Shipment Back to a Magnesium Mill for Re-use. Steel, Aluminum, Copper, Beryllium Bronze, Phosphor Bronze, Aluminum Bronze, and Brass are Other Scrap Metals being Saved by a Strict Salvage Routine

Portable Scrap Receptacles are Painted with Varicolored "V's" to Designate Different Metals. If the "V" Tag on the Machine Tool Tallies with a Receptacle Designation, the Scrap from That Machine can be Placed in the Receptacle. This Scheme Segregates the Various Metals for Return to the Salvage Points

in a steady stream to a central salvage yard from where it is shipped to reclaiming points, usually on the same day that it enters the yard. So large is the quantity of metal salvaged that mechanical shovels are necessary for loading it on railroad cars and trucks. One of the Wright plants has an individual chip-handling system with overhead hoppers which can load a gondola type railroad car in eight minutes.

Employe organizations have also begun a tin-can salvage drive, using the collective efforts of thousands of employes coming from dozens of communities. Containers are placed at every entrance where employes coming in to work may deposit cans previously cleaned, de-labeled, and flattened for convenience in shipping. As fast as is practicable, shipments in bulk are to be made to de-tinning points. The proceeds from tin-can salvage will be contributed by the employe organizations to war relief funds.

Simplified Practice for Files and Rasps

THE Standing Committee of the File and Rasp Industry has proposed a revision of the Simplified Practice Recommendation R6-40, Files and Rasps. In this revision will be included important data on dimensions, cuts, and tolerances, which will greatly enhance the value of the recommendation. The simplification of files and rasps was first undertaken by the industry in cooperation with the War Industries Board in 1918. At that time, the varieties were reduced from 1351 to 619, or 54 per cent; in 1923, there was a further reduction from 619 to 496; in 1940, the number of standard items was reduced to 377. The proposed revision lists 374 items. Mimeographed copies of the proposed revision can be obtained free of charge from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

Engineering News Flashes

Taking Photographs of Bullets in Action

Twin X-ray units, each capable of delivering a charge of 2000 amperes at approximately 300,000 volts in a millionth of a second, will soon be used by U. S. Army ballistics technicians to study the action of bullets within gun barrels and as they pierce steel armor plate. This research will be directed by Lieutenant Colonel S. C. Fletcher, officer in charge of Frankford Arsenal Laboratory. The Westinghouse X-Ray Division built the equipment.

Though a bullet travels at 2 1/2 times the speed of sound, the new X-ray photographic technique permits making two separate exposures of film during the flight of a single bullet. The two X-ray machines will stand side by side, and the elapsed time between two exposures can be varied from a five-hundredth of a second to a millionth of a second. Two exposures can also be made simultaneously. Penetration of an inch of steel with the most powerful regular type of industrial X-ray machine would require 10,000 times as long, because the conventional tube cannot withstand the amperage necessary.

Rubber Safety Equipment to Prevent Munition Plant Blasts

Munition plant safety equipment designed to help eliminate explosions through the use of a unique type of electricity-carrying rubber has been developed by the United States Rubber Co. In the last war, workers in powder and shell factories often went barefoot to prevent blasts from body sparks. To remove this danger, the new rubber—known as "conductive" — was developed to carry a charge of electricity, at the same time keeping the other characteristics of rubber. When powder plant workers' shoes have soles and heels of the new substance, the body electricity is dispersed through the feet into the flooring which may be made of the same material to carry off the charge.

Containers for the powder, table tops, and any other spot where electricity might collect, likewise make use of the material. Belting made of conductive rubber carries off the static electricity which collects from its motion. The material is particularly valuable for use in hose which may be charged with electricity, generated by the friction of particles passing through it.

Motion Pictures Showing Tool Action in Transparent Plastics

An interesting development in the motion picture field is the utilization by the Emerson Yorke Studio, New York City, of the plastic Lucite to demonstrate the cutting action of drills and taps. Heretofore, animated line drawings have been considered the most practical method of portraying the action of tools inside opaque objects. By the use of Lucite — a transparent plastic possessing unusual light-transmission properties—the action of a tool when drilling or tapping can be clearly shown with the motion-picture camera.

Paint that Makes Objects Visible in the Dark

A luminous paint which can be applied to objects of all kinds to render them visible in the dark has been developed by the Maas & Waldstein Co., Newark, N. J. Unlike the radio-active finishes commonly used on watch dials, the new paint is said to owe its luminous characteristics to a substance that re-radiates light. It contains no toxic materials. After the paint has been exposed to either daylight or ordinary electric illumination for a few minutes, it glows for about twenty hours, and repeats this action after re-exposure.

The new paint is known as "Durad Luminous Paint." It must be used over a special primer and thinned out with a special thinner, both of which are supplied with the paint. One thick coat (or preferably several thin coats) of the paint produces a flat white finish suitable for indoor service. For a glossy finish or for outdoor service, the paint is covered with a special clear top coat. Each coat of the paint will dry in the air in from one to four hours, depending upon the weather conditions.

New Electrolytic Process for Plating Steel with Tin

An electrolytic process for plating strip steel with tin that is more economical as regards both tin and electric power than previous methods has been developed by the Electroplating Division of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. The process is known as the

Halogen tin process. It is said to eliminate sludging and the consequent waste of tin. According to the company developing the process, strip steel for containers can be tin-plated twice as fast, with less electric power, by this process than by the "alkaline" electro-tinning method. Because of the limitations on the use of tin due to war demands, a larger percentage of tin cans will be plated by the electrolytic process in the future, due to the thin coatings of the metal possible when this process is used.

Tin deposited by the Halogen process can be heated without discoloration, either when heated to obtain the bright finish desired by some can manufacturers, or when heated during the process of applying lacquers or enamels.

Electric Eye Operates to Turn out Lights in Blackouts

The electric eye, which has found many interesting uses in the past, is now available as an all-night guard, alert to warnings of possible air raids. The electric eye is focussed on street lights, which are turned off the instant a warning is received in any city. As soon as the lights are turned off, the electric eye not only sounds an immediate warning, but, likewise, turns off the lights in the home, store, display sign, or other light source that is to be extinguished in a blackout. The idea originated with Andrew Tessier, who, with his brother, conducts a small machine shop in Schenectady, N. Y.

The electric eye equipment for this purpose costs about $30, with possibly another $10 for the installation expense. This arrangement might be especially useful to shops and merchants who do not employ an all-night watchman and who now must turn out lights at night.

Photographs Can Now be Taken in the Dark

Photographs can now be safely made during blackouts. Two new photoflash lamps, which have been developed by the Westinghouse Lamp Division, produce invisible infra-red light which makes it possible to take pictures on infra-red film in the dark. The lamps are made with special glass that will not pass the visible light produced by the flash, but will pass the picture-making invisible infra-red rays.

Pieces of Metal and Chips Swept from the Shop Floors in the Westinghouse Plants are Recovered, as Shown in the View at the Left, by a System of Trays and Buckets in which the Metal Pieces Settle to the Bottom while Water Carries away the Dirt. Through This and Other Processes at the Linhart Works, East of Pittsburgh, the Westinghouse Company Reclaims about 20 Tons of Non-ferrous Ingot Metal Daily from Machine Shop Scrap and Dirt. Iron Scrap is Removed from the Reclaimed Non-ferrous Metals, as Shown in the Illustration at the Right, by a Magnetic Separator that Holds the Ferrous Materials on a Conveyor Belt, but Deposits the Remainder in a Box

EDITORIAL COMMENT

People unfamiliar with manufacturing practices, or those having merely a surface knowledge of the subject, speak of conversion from peace to war work as if it were a simple matter that any manufacturer might decide to do overnight. They do not realize that you cannot just stop making automobiles, refrigerators, radios, or washing machines one day, and start making tanks or anti-aircraft guns the next morning. They do not realize the length of time that it takes to tool up a plant for a new product. Nor are they aware of the fact that, if the peace work is stopped abruptly, tens of thousands of people are thrown out of work—not only the people who make the products, but also those who sell and service them.

Conversion of Great Industries is Not a Simple Task

If great hardships are not to be placed upon the people employed in these industries, as was the case in the automobile industry, it is necessary to make the change-over to war work a gradual process. Furthermore, through a gradual change-over, it may be possible to save millions of dollars worth of partially fabricated materials that otherwise would be wasted without in any way benefiting the war effort.

It has taken time to set up our industrial machine for war production. Most people do not realize how long ago many of the large industries began the job of conversion, and how hard the management and the engineers have worked in order to get into war production at the earliest possible moment. The industrial machine is very complex. The gears through which it operates so efficiently cannot be changed by a single movement of a lever; but the minute that the machine is geared for full speed ahead on the war production road, it has the capacity to outproduce any other nation.

In May MACHINERY, page 122, reference was made to the necessity for reserves for conversion to peace work when the war is won. The difficulties confronting a manufacturing company that tries to accumulate an adequate reserve, because of the present methods of collecting undistributed profits taxes, were emphasized.

Now the Government proposes to take so large a proportion of "excess profits" that there will be practically nothing left for the expense of changing over to peacetime work at the end of the war. This provision accentuates the difficulty. It has been questioned whether such an extreme tax measure will prove satisfactory even from a fiscal point of view. Extreme excess profits taxes greatly reduce the incentive to economy; they reduce the incentive to devise cheaper and quicker ways of doing work. Some reasonable incentive to achieve manufacturing efficiency should always remain.

The *New York Times* makes a suggestion that may have considerable merit. "Suppose, for example," says that newspaper in one of its editorials, "that the Government took . . . 100 per cent [of the excess profits]; but that, of this amount, it retained permanently only 75 per cent, and agreed to return 25 per cent after the war. This would be, in effect, a program of taxation plus compulsory savings. The corporation would then save, on net balance, 25 cents out of every dollar earned by efficient methods of production, and the incentive to efficiency would not be so greatly reduced. But it would not be able to use this 25 cents during the war. It would be forced to leave it with the Government until the end of the war." In this way, a reserve could be accumulated for industrial corporations that would help tide them over the reconstruction period that is certain to require ready cash.

Turning Corporation Taxes into Reserves for the Future

Whether this method would be practicable or not is not the question, so much as that *some* method ought to be devised by our Treasury Department, and adopted by Congress, by which corporations would be able to accumulate sufficient reserves to insure that they will be able to continue in business—continue to keep labor employed—when the present war material production no longer assures a job to everyone able and willing to work.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Inserting and Heading Tubular Rivets

The operating mechanism of the Chobert magazine riveting machine employed in a British bomber manufacturing plant is shown in the accompanying illustration. The sectional views at *X* show the successive stages in the riveting operation. The machine employs a pull-rod with a dolly or conical expanding tool *F* at one end, the diameter of which is slightly larger than that of the main bore through the tubular rivet. As the dolly is pulled through the rivet, it forms a head at the inner end and expands the shank so that it is a tight fit in the hole.

The machine has a hand-grip at *A* and a housing *B* for the crank-operated gear and cam mechanism whereby a sliding movement is imparted to sleeve *C*. Shroud *D* is attached to the end of this sleeve and moves with it to operate the jaws of chuck *E*.

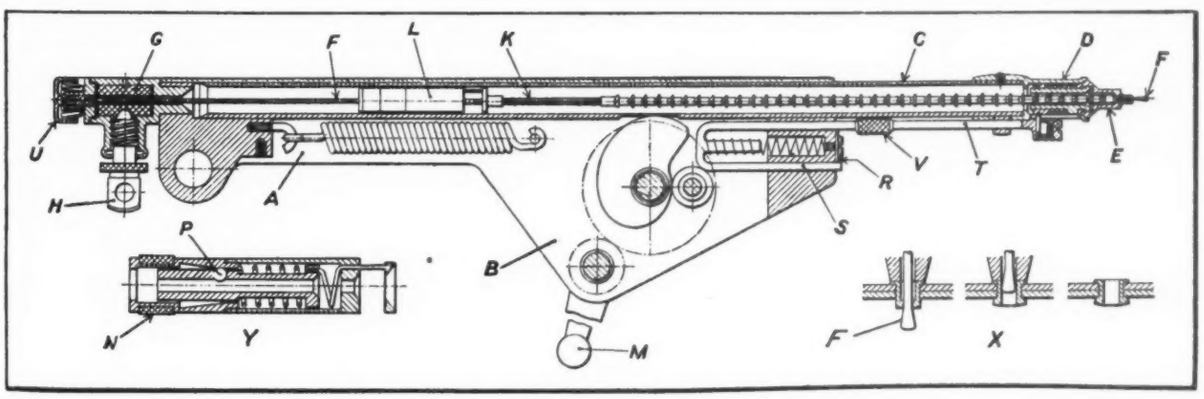
The pull-rod or dolly *F* extends through the barrel of the machine and is held fast by jaws at *G*. Pressure on the jaws is applied by screw *H*, the arrangement permitting the rod to be removed when it is necessary to load the rivets, which are slipped over or threaded on the rod with the flanged ends toward the rear of the machine, as shown. A shouldered check-spring *K* is next threaded on the rod, the small end of which is inserted in the barrel, passed through the center of feed unit *L*, and gripped by jaws *G*. With chuck *E* closed, the first rivet is exposed with its flange seated against the chuck end.

The first rivet is inserted in one of the drilled holes in the gusset and tubular member, the dolly and end portion of the rivet projecting into the tube. Three turns of crank *M* are required to complete the riveting operation and reset the machine.

As mentioned, the cam mechanism in housing *B* imparts a forward movement to sleeve *C*, and with it, to shroud *D* and chuck *E*, the rod and rivets remaining stationary. Any movement of crank *M* when the rivet and chuck are pressed against the work will cause the body of the machine, and with it the rod, to retire. Thus, the dolly is withdrawn, completing the riveting operation as explained. This occurs during the first turn of the crank, after which the riveting machine is withdrawn slightly from the work.

During the second and third turns of the crank, the chuck jaws advance, permitting the passage of the next rivet, and close behind it. The machine is then ready for operation again. When operated by an experienced worker, the machine will close 1200 rivets per hour.

The feed unit of the machine is shown to a larger scale in the cross-section view at *Y*. A split ring *N* is a good sliding fit in sleeve *C*. Ball *P* rides to the large end of the taper bore shown when rod *F* is in position and is moved to the left during the riveting stroke. On the return or loading stroke, ball *P* is forced down the taper so that it grips rod *F*, the movement being assisted by the coil spring, and the entire unit is carried forward through a distance corresponding to the length of one rivet.



Cross-section of Chobert Riveting Machine, Showing Essential Features of Operating Mechanism

It is necessary to reload the rod when the magazine is empty, and to do this, jaws *G* are released by loosening screw *H*. Crank M is then given 2 3/4 turns to open the chuck jaws at *E*. With the jaws open, stop *R* is moved to engage a slot in the portion *S* of control rod *T*. Thus, the jaws are locked in the open position to permit the withdrawal of the empty rod and the insertion of another rod loaded with rivets. With the loaded rod in position, stop *R* is released, allowing the jaws to close. There should be a clearance of from 0.6 to 1 millimeter between the head of the exposed rivet and the end of the chuck jaws; if this is not the case, adjustment can be effected through the medium of cap-screw *U*, the threaded portion of which engages the end of rod *F*.

Lever Mechanism for Operating a Locking Pin and Clamping Bolts in One Movement

By F. SERVER

The mechanism illustrated in Fig. 1 is employed on the swivel type fixture shown in Fig. 2 to withdraw a locking pin and release two clamping bolts in one movement of the hand-lever. The reverse operation of engaging the locking pin and tightening the clamping bolts

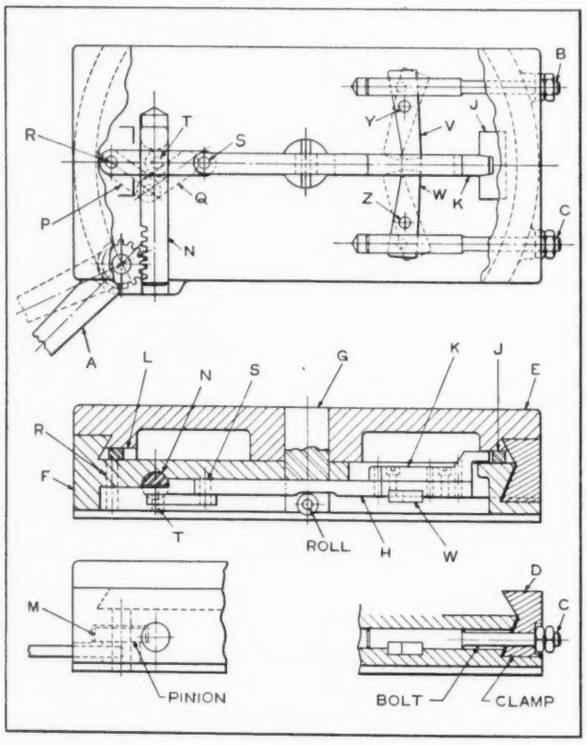


Fig. 1. Mechanism for Operating a Locking Pin and Two Clamping Bolts in One Movement of a Hand Lever

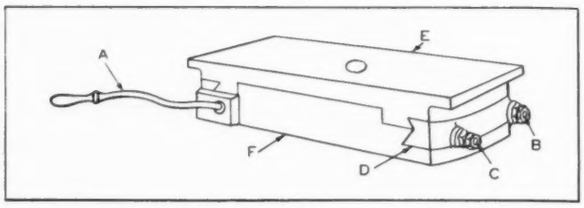


Fig. 2. Swivel Type Fixture Equipped with Locking Mechanism Shown in Fig. 1

is similarly accomplished by a simple return movement of the lever.

Referring to the illustrations, it will be noted that hand-lever *A* is located near one corner of the fixture in a convenient operating position and at some distance from locking pin *K* and the two clamping bolts *B* and *C* which it actuates. The clamping bolts act on both ends of the dovetail segment *D*, lever *A* being the clamping medium.

The purpose of the entire unit is to bind upper portion *E* of the swivel base to the lower portion *F*. Stud *G*, which passes through the entire unit, is slotted and has a roll at its lower end. Bar *H* passes through the slot in stud *G* and rests on the roll. Stud *G* serves as a pivot on which section *E* can be swiveled. Swivel section *E* is located on the base by locking pin *K* which fits the slot in plate *J* attached to member *E*, while another plate at *L* serves to locate the swivel section when it is reversed or revolved through an angle of 180 degrees.

Pinion *M*, attached to operating lever *A*, meshes with a rack bar *N*. There are two toggle levers *P* and *Q*, lever *P* being pivoted at one end on pin *R*, fixed in base *F*. The other end of this lever is connected to one end of lever *Q*, the outer end of which is connected to bar *H* by pin *S*. Pin *T* acts as a fulcrum for the toggle joint.

At this fulcrum point, the ends of the levers are yoked into a cross-slot in the rack bar, so that, as the rack is moved into the position shown, the toggles force bar *H* into the clamping position. When lever *A* is in the position shown by the dotted lines, the toggles are likewise in the positions shown by dotted lines, which results in withdrawing the clamping bar from plate *J* and unlocking dovetail clamp *D*, at which time two levers (shown at *V* and *W*) assume the positions shown by the dotted lines.

Levers *V* and *W* engage a slot in the lower side of bar *H* and pivot on pins *Y* and *Z*. These levers also have yoke connections with the two clamping bolts *B* and *C*, so that a solid metal-to-metal contact is provided. In effect, this forms a quick-operating, toggle-action mechanism by means of which the simple action of moving lever *A* is all that is necessary to unlock and unclamp upper member *E*.

HOW TO SELECT SMALL ELECTRIC MOTORS

The proper selection of 1/8 to 3/4 H.P. motors for light industrial machines and household equipment is indicated in this table.

Type and Sizes	Where to Use	Features and Characteristics	Power Supply	Speeds
Split-Phase High-Torque 1/6-, 1/4-, and 1/3-H.P. High Starting Torque	Woodworking tools, sump pumps, tool grinders, home workshop and similar applications not starting under heavy load	Sleeve bearings. Indestructible rotor. Rigid or resilient mountings	Single-phase; 60, 50, or 25 cycles; A.C.; 110 or 220 volts	1725 R.P.M. on 60 cycles; 1425 R.P.M. on 50 or 25 cycles
Split-Phase General-Purpose 1/20- to 1/3-H.P. Medium Starting Torque	Fans, blowers, oil burners, centrifugal pumps, unit heaters and other easily started machines. Use where frequent starting is required and normal starting and running torques are sufficient	Low starting current prevents light flicker. Sleeve bearings. Ball bearings. Thermal protection optional. Quiet running. Reversible. Rigid or resilient mounting	Single-phase; 60, 50, or 25 cycles; A.C.; 110 or 220 volts	3450, 1725, or 1140 R.P.M. on 60 cycles; 1425 R.P.M. on 25 cycles
Capacitor-Start, General-Purpose 1/6-, 1/4-, 1/3-, 1/2-, and 3/4-H.P. Extra High Starting Torque	Pumps, machine tools, refrigerators, compressors, water-coolers, air-conditioners, and similar equipment needing heavy starting power	Capacitor gives low starting current and prevents light flicker. Few wearing parts. Quiet. Thermal protection optional. Rigid or resilient mounting	Single-phase; 50 or 60 cycles; A.C.; 110 or 220 volts for 1/4-H.P. and smaller. Larger sizes, 110-220 volts	3450, 1725, and 1140 R.P.M. on 60 cycles; 1425 R.P.M. on 50 cycles
Polyphase 1/6-, 1/4-, 1/3-, 1/2-, and 3/4-H.P. High Starting Torque	Companion to single-phase motors. Special designs furnished for hoists, etc., that require extra high starting torque.	All ratings permit starting across line. Rigid mounting standard. Ball bearings optional equipment. Sleeve bearings standard. Protection usually provided in control	Two- or three-phase; dual frequency; 60, 50 cycles; 110, 220, 440, 550 volts; A.C.	3450, 1725, and 1140 R.P.M. on 60 cycles; 1425 or 960 R.P.M. on 50 cycles
Direct-Current 32, 115, and 230 Volts	Suitable for all direct-current applications	Ratings below 1/2-H.P. can be started across line. For ratings of 1/2-H.P. and above, starting rheostats are advised	Direct-current; 32, 115 and 230 volts	1725 and 1140 R.P.M.

MACHINERY'S Data Sheet No. 468, June, 1942

Compiled by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MACHINERY, June, 1942

LOADS AND DEFLECTIONS OF STAINLESS-STEEL ROUND-WIRE HELICAL SPRINGS—5

Outside Diameter of Spring, Inches	Diameter of Wire, Inches					
	0.331	0.363	0.394	0.430	0.460	0.490
Upper Figure, Maximum Safe Load P, in Pounds; Lower Figure, Deflection y, in Inches per Coil						
1 3/4	230 0.0417	All values in this table are based on 31,500 pounds per square inch fiber stress, and are for severe service. For average and light service, multiply these values by 1.25 and 1.55, respectively.				
1 7/8	217 0.0507	283 0.0428				
2	206 0.0606	267 0.0514	338 0.0443			
2 1/4	185 0.0831	242 0.0713	306 0.0618	396 0.0526	.....	.....
2 1/2	168 0.109	220 0.0944	279 0.0822	362 0.0710	436 0.0629	521 0.0559
2 3/4	154 0.138	202 0.121	256 0.106	333 0.0920	400 0.0822	481 0.0733
3	142 0.172	187 0.150	237 0.133	308 0.116	371 0.103	444 0.0928
3 1/2	123 0.248	161 0.218	206 0.195	267 0.171	323 0.155	390 0.140
4	108 0.339	142 0.300	181 0.268	237 0.238	286 0.216	343 0.196
4 1/2	96.8 0.444	128 0.394	162 0.353	212 0.314	256 0.287	308 0.263
5	87.0 0.563	115 0.501	146 0.452	190 0.402	231 0.368	278 0.339
5 1/2	79.5 0.697	105 0.622	134 0.564	174 0.502	212 0.459	255 0.423
6	73.0 0.847	96.0 0.755	123 0.682	160 0.612	194 0.561	234 0.518

Table of Wahl Factor Values

$C = \frac{D}{d} = \frac{\text{Mean diameter of spring}}{\text{Wire diameter}}$ K_1 = Wahl Factor

C	K_1	C	K_1	C	K_1	C	K_1	C	K_1
2.0	2.06	3.3	1.51	4.6	1.34	6.8	1.22	12.0	1.12
2.1	1.98	3.4	1.49	4.7	1.34	7.0	1.21	13.0	1.11
2.2	1.90	3.5	1.48	4.8	1.32	7.2	1.21	14.0	1.10
2.3	1.84	3.6	1.46	4.9	1.32	7.4	1.20	15.0	1.10
2.4	1.79	3.7	1.44	5.0	1.31	7.6	1.19	16.0	1.09
2.5	1.75	3.8	1.43	5.2	1.30	7.8	1.19	17.0	1.08
2.6	1.71	3.9	1.42	5.4	1.28	8.0	1.18	18.0	1.08
2.7	1.68	4.0	1.40	5.6	1.27	8.5	1.17	19.0	1.07
2.8	1.64	4.1	1.39	5.8	1.26	9.0	1.16	20.0	1.07
2.9	1.60	4.2	1.38	6.0	1.25	9.5	1.15	22.0	1.065
3.0	1.58	4.3	1.37	6.2	1.24	10.0	1.14	24.0	1.06
3.1	1.56	4.4	1.36	6.4	1.24	10.5	1.14	26.0	1.055
3.2	1.53	4.5	1.35	6.6	1.23	11.0	1.13	28.0	1.05

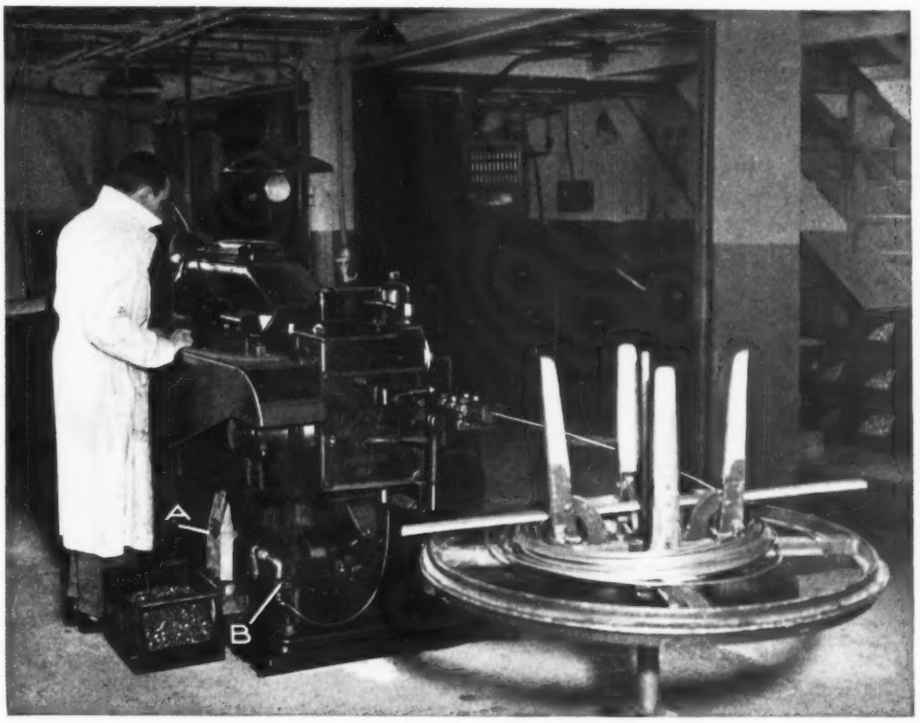
For maximum safe load and deflection formulas, see Data Sheet No. 463, April, 1942.

MACHINERY'S Data Sheet No. 467, June, 1942

Compiled by J. L. Hommel Westinghouse Electric & Mfg. Co.

Manufacturing Rivets for Airplanes

By M. W. SEAVEY, Tool Design Department
Lockheed Aircraft Corporation



Used in Quantities that Run into Millions, the Airplane Rivet Must be Accurately Made to Carefully Worked-Out Designs. How This is Accomplished in Mass Production is Described in This Article—Second of Two Articles

Approved for Publication by the War Department

IN the first installment of this article, the various types of airplane rivets were described and the process of rivet fabrication up through the head forming operations was discussed. The present installment concludes the description of the manufacturing methods.

As the rivet blank is being pushed into the die insert, the end is chamfered. The form of the chamfer is made in the die insert. This die insert assembly is shown in the machine in Fig. 16 supporting the rivet *A*. The detail parts are shown in Fig. 19. *A* is the die insert; *B*, the die-insert holder; *C*, the backing-up block; and *D* the ejector-pin. The large end of the ejector-pin is a slip fit in the backing-up block, and the small end is a slip fit in the die insert. When the rivet has been completed, a cam operates a push-rod which pushes the ejector-pin forward and ejects the rivet from the machine. A rivet is shown almost out of the die insert at *A* in Fig. 16. The push-rod is returned to the normal position by spring pressure, and the ejector-pin is returned by the next rivet blank pushing it into place.

The die inserts are long enough to chamfer the ends of rivets having lengths up to six times their diameter. When rivets longer than these are required, it is necessary to make a solid type die, as shown at *C* in Fig. 17, and another style of ejector-pin, as shown at *D*. In making square-end rivets, only one die is required for all lengths, the length of the rivet being controlled by the adjustment of the ejector-pin in the machine. To conserve material and thereby lower

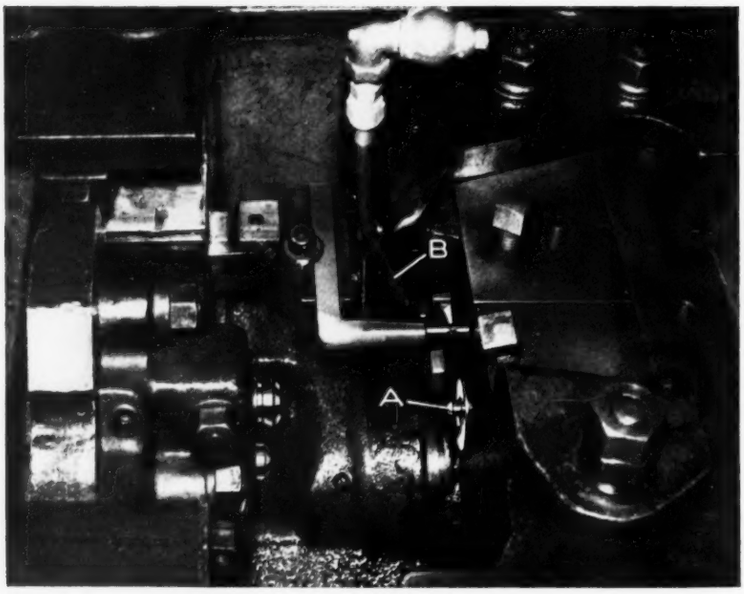


Fig. 16. Close-up View Showing the Finished Rivet A being Ejected from the Die Insert while another Blank is about to be Cut Off

the cost of the solid type dies, they are always made reversible, which allows for maximum wear in the diameter of the hole.

In order to be sure that the rivet drops into the bed of the machine when it is ejected, a blast of air is directed on the rivet as it is leaving the die insert. This blast of air is controlled by a valve (seen at *B* in the heading illustration), which is operated by the ejector-pin operating cam. This valve is provided to permit the operator to shut the air off while he is setting up the machine. The air is delivered to a position over the rivet, as indicated at *B* in Fig. 16. Sometimes a rivet will tend to stick to the ejector-pin or finishing punch, due to oil adhering on the rivet. In such a case, the air will blow the rivet out of the way, so the next one can be made.

The finished rivets are delivered through a chute *A*, as shown in the heading illustration. The clean-out hole cover is shown in the open position and the gate is also shown pulled out, which allows the rivets to fall through into the pan below. Normally, the gate is closed while the machine is running. About every five minutes the operator checks his machine to see that it is producing good rivets, and, if so, he opens the gate and lets the good rivets drop into the

Fig. 17. (Left) Impression for Heads of 100-degree Countersunk Rivets Shown in Die Inserts H and K and Solid Dies C and J. Other Die Inserts and Ejector-pins are Also Shown.

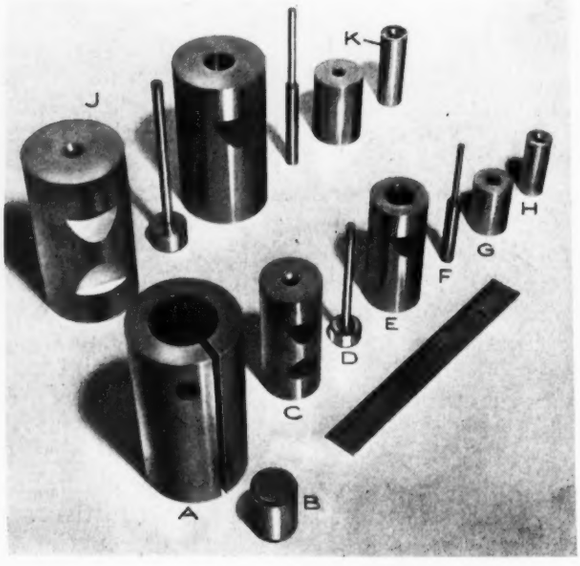
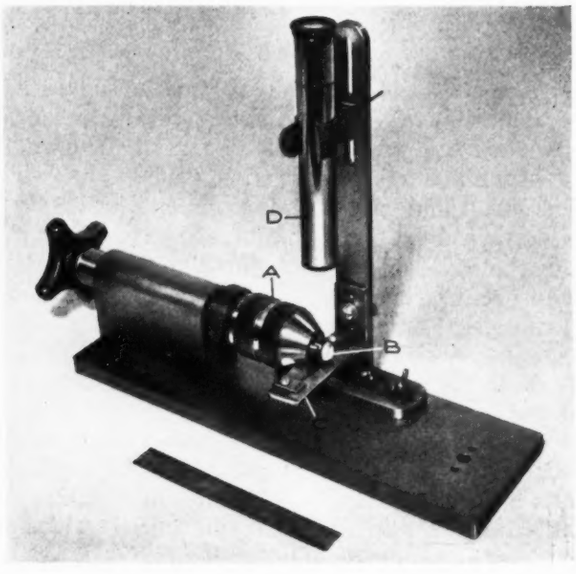


Fig. 18. (Right) Fixture for Checking Concentricity of Rivet Heads Relative to Shank



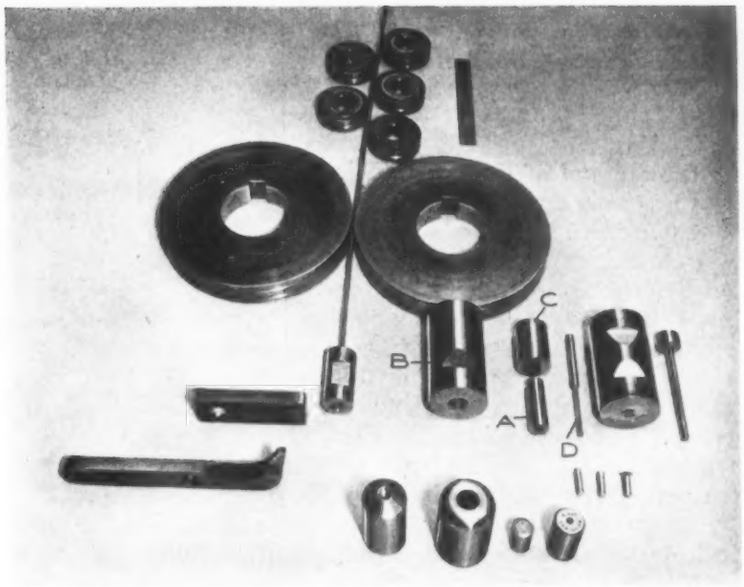


Fig. 19. Lay-out of Parts for Rivet-forming Machine Similar to That Shown in Fig. 7 in the First Installment, but for Larger Rivets

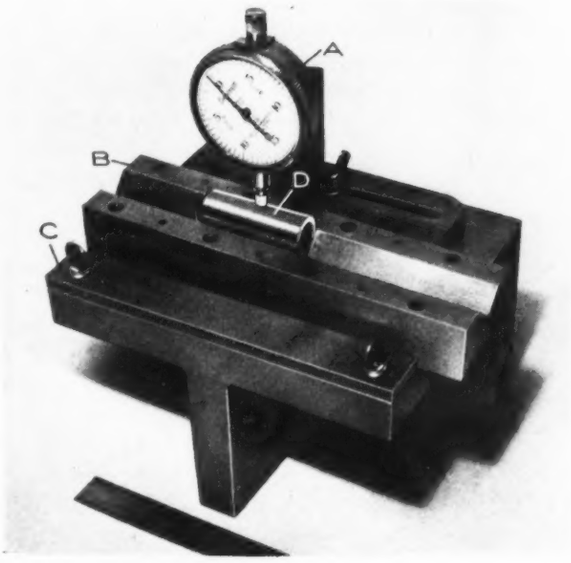
VICTORY

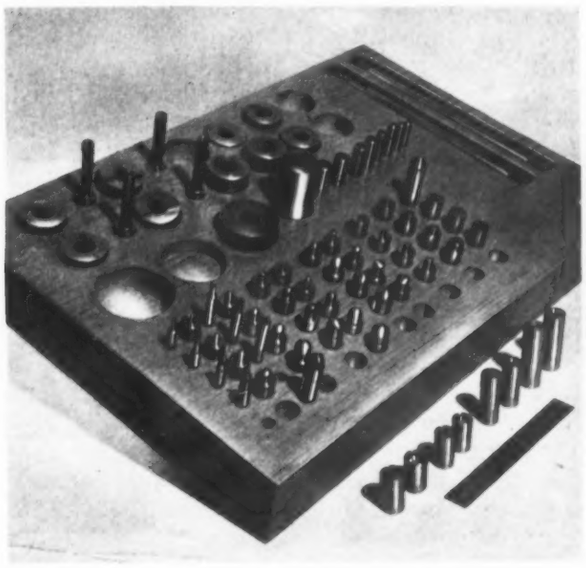
pan below. If, for any reason, the tools have become broken or gotten out of adjustment, and the machine is producing imperfect rivets, the operator corrects the condition, removes the pan, and then opens the gate to remove the imperfect rivets, thus preventing them from getting into the production stock.

If it should become necessary to run the smaller-diameter rivets in the larger machine, an adapter *A* and push-rod extension *B* are provided, as shown in Fig. 17.

In making the 100-degree countersunk rivet, the impression for the head is in the die insert, and the head, therefore, is perfectly concentric with the shank. This impression can be seen in the die inserts *H* and *K* in Fig. 17, and in the solid dies *C* and *J*. It is necessary to accurately control the depth of the countersink or dimpled impression in the skin sheets. Adequate tools to accomplish this have been made in the shop for the manufacturing departments. No difficulty has been encountered in manufacturing the rivets because the complete impression of the rivet head is in the die insert, as shown in Fig. 22. The diameter of the head is not the important dimension, although this is controlled by the die insert. The important dimension is the relation of the sides of the 100-degree angle

Fig. 20. (Left) Gage for Checking Taper of the Die Insert D. If Taper is Correct, No Reading is Shown on Indicator A as Slide-block B is Moved Back and Forth. Fig. 21. (Right) Wooden Blocks are Used to Store the Tools and Accessories in Steel Cabinets





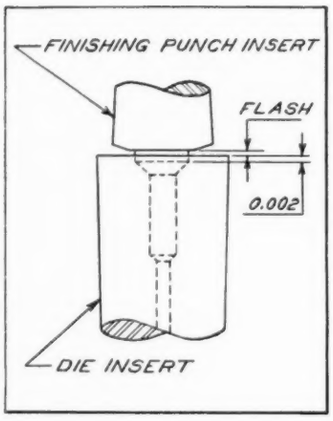


Fig. 22. Die Insert and Finishing Punch at Final Stage of Forming Rivet Head, Showing Clearance Left for Flash

to the top end of the rivet. This can be easily controlled to within 0.002 inch.

In making all other types of rivets, the concentricity of the head relative to the shank is controlled by adjustments in the rivet-making machine. The fixture for checking the concentricity is shown in Fig. 18. The rivet *B* is inserted in chuck *A*, and by looking through the eye-piece *D*, the relative concentricity can be read on scale *C*. The machine is then adjusted as required until the concentricity of the rivet head comes within the tolerance prescribed by the engineering department. The telescope has a 3-X magnification.

In order to have the rivet sets fit the contour of the AN430 round-head rivets properly, it is necessary to make the shape of the finishing die inserts accurate. The correct fit is shown at *C*, Fig. 23. If a condition as shown at *B* exists, it will leave a ring on the rivet head. The impression or head contour is hubbed in the finishing punch insert. First, a finishing punch insert blank is made from high-carbon, high-chromium steel in the turret lathe, and is rough-tapered. This blank then goes to the centerless grinder, where it is fitted to a ring gage, which is made 0.010 inch over size in diameter. Next, the blank is put into an adapter and finished roughly to length on both ends. The recess is then roughed out with a lathe tool and reamed. The blank is next set into the lower hubbing ring; the upper hubbing ring is put over the lower ring and the hub is inserted in the upper ring. The unit is then placed in a hydraulic press and the blank is hubbed to size. Next the identification marks are hubbed in.

After this, the blank is hardened, polished, and ground to produce the correct height of rivet head. It then returns to the centerless grinder for the final grinding of the taper in relation to the diameter, so that it will fit correctly into the adapter.

In order to insure accuracy in the final grinding of the taper, the gage shown in Fig. 20 is used in the following manner: The insert blank *D* is placed in slide-block *B*. Block *B* is moved back and forth against guide plate *C*. If the taper is correct, no movement of indicator *A* will take place. If the taper is incorrect, the indicator will show how much is needed for correction of the taper attachment on the centerless grinder.

The finishing insert is assembled to the adapter with a press fit, a three-ton load being required for the operation. This preloading keeps the finishing punch inserts from breaking under the heavy pressure of forming the heads on the rivets.

On the 3/16-inch diameter and larger sized rivets the rivet machines are run at approximately 400 R.P.M. These are double-stroke machines which produce one completed rivet for every two strokes of the ram. The shorter rivets are turned out at the rate of 200 per minute, and the longer ones at 150 per minute. On the single-stroke machines, a rivet is produced at each stroke of the machine, and on the shorter lengths, 400 rivets per minute are often produced.

After the rivets have been made and the flash has been removed by tumbling, they go to final inspection and then to the rivet stores department. Those rivets made from 24S materials must be heat-treated, and maintained at a temperature below 32 degrees F. until they are ready to be used on the production line. The incoming rivet wire and the completed rivets are weighed on No. 502 CB Howe counting scales.

A No. 3R Sheldon arbor press, with a ratio of 72 to 1 and exerting approximately 7 1/2 tons, is used for pressing the die inserts in and out of their holders. This is ample capacity, as it requires only about 3 tons to push the inserts flush with their holders.

A steel cabinet is furnished in which to keep all the tooling. Wood blocks with holes drilled in them are fitted into the drawers, and the tools are set into the holes, as shown in Fig. 21. This keeps them from becoming lost or damaged.

Some of the "riveting practices" used in the shop and inspection department may be of interest. In Fig. 24 are shown the more common methods of riveting structures.

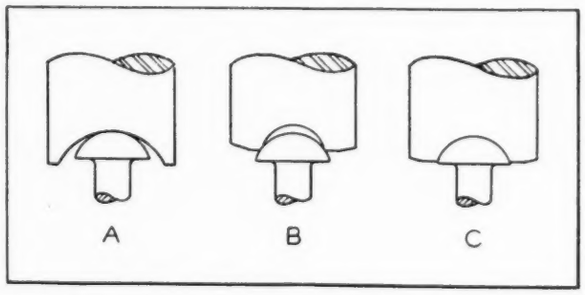


Fig. 23. Incorrect (A and B) and Correct (C) Fit of Rivet Set to Contour of Round-head Rivet

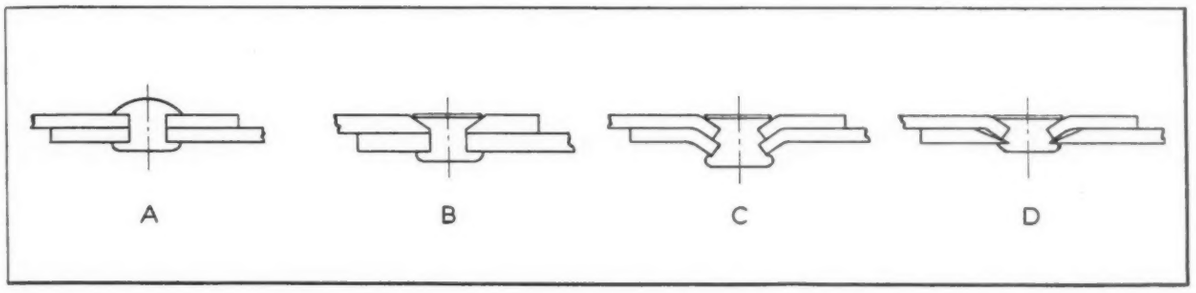


Fig. 24. Common Methods of Riveting: (A) Use of Round-head Rivet; (B) 100-degree Flush Type Rivet Used with Countersunk Sheet; (C and D) 100-degree Flush Type Rivet Used without Sheet being Countersunk

At *A*, two pieces of metal are riveted together with a round-head rivet; at *B*, a 100-degree flush type rivet is used, the outer sheet having been countersunk to receive the angular head. Machine countersinking should not be used where the thickness of the sheet to be countersunk is less than the value given in the accompanying table for the various rivet diameters.

The following excerpts from the Lockheed Specifications Book will give a general idea of the rivet requirements as applied to production in this plant:

"The smoothness of flush surfaces shall be as nearly exact as is practicable. Particular care shall be taken in the fabrication of flush surfaces forming the leading edges of wings, as the smoothness of these surfaces is an important aerodynamic consideration.

"Rivets shall be set in a workmanlike manner. Indications of poor workmanship, such as excessive tool marks and other defects, shall be held to a minimum.

"The diameter of the manufactured rivet heads after driving shall not be more than approximately 5 per cent larger than the diameter of the undriven rivet. However, a few large heads shall not be considered cause for rejection, provided approximately 98 per cent of the rivets meet the above requirement.

"Predimpling shall be considered the preferred method for pressure cabins and gas-tight seals, and shall be used except where the structure is such that the dimpling operations cannot be carried out with the usual equipment.

"When the lower member is an extruded section and is to be dimpled, the hole in it shall be chamfered on the under side.

"Wherever the lower sheet is dimpled, the upset head shall be formed with a conical set when practicable.

"To measure projections above the skin surface, a straightedge is laid on the head along the diameter of the rivet, and the projection of the rivet measured by sliding a feeler gage between the skin and the straightedge at the edge of the rivet (see left-hand view in the illustration Fig. 25).

"To measure depressions of rivets below the surface of the skin, a straightedge 1 inch long is placed across the rivet and rested on the skin on both sides of the rivet head. A feeler gage is then placed between the straightedge and the edge of the rivet (see right-hand view in the illustration Fig. 25).

"In no case shall more than 40 per cent of the rivets be above or below surrounding surfaces (as defined above) by more than 0.002 inch, while 20 per cent is considered a practicable and desirable standard of general workmanship."

The flat set has been used to advantage on the round-head rivets, and has become accepted as a standard practice.

Minimum Sheet Thickness for Machine Countersinking

Rivet Diameter, Inch	Minimum Thickness of Sheet, Inch
3/32	0.032
1/8	0.040
5/32	0.051
3/16	0.072

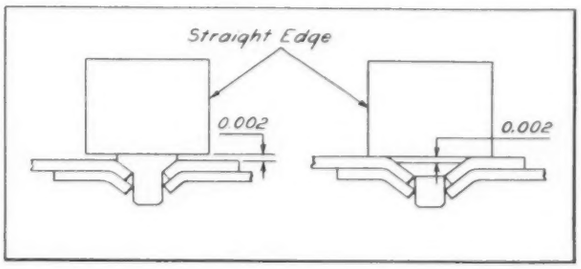


Fig. 25. Method of Testing Rivets for Elevation and Depression with Relation to Skin Surface

What the Product Designer Should Know About Plastics

Characteristics and Application of Plastics, and Directions for the Design of Plastic Molded Parts for Economical Quantity Production—Fourth of Five Articles

By ERIK FURHOLMEN, Chief Estimating Engineer
Chicago Molded Products Corporation

INSERTS, when properly designed and located, are very useful in moldings. Their purpose is generally to take stresses (or to avoid wear) that ordinarily are too great for the plastic part itself, or to provide electrical conductors. Steel and brass are the most commonly used among the metal inserts. Brass is preferable, especially where great length is required, because its coefficient of expansion more nearly approaches that of the average plastic material; hence, cracking is less likely to occur with changes in temperature. It is sometimes essential, and always desirable, to so locate inserts that the axis of the protruding portion of the insert is at right angles to the mold parting, as the insert must clear the mold when the molding is removed.

Inserts that are to be molded in place should be designed with coarse diamond knurls, undercuts, holes, or similar irregularities of the surface, to insure good mechanical anchorage in the plastic. They should be designed so that they can be securely held in the mold without bending and without shifting their location during the molding cycle. To accomplish this often calls for ingenious designing, but it is well worth the effort, as an insert that does not stay in place is a source of much trouble and expense.

Inserts generally, and preferably, have those parts that protrude from the molding and that extend into, or are supported by, the mold circular in section—that is, cylindrical in shape. Often these parts have an external or internal thread. The diameters of inserts, both inside and outside, are generally quite easily held to close tolerances, and such tolerances should be so specified on the blueprint. Limits of plus or minus 0.001 inch or less should be maintained, so that the insert will fit either into a hole or over a pin by which it is to be located. Inserts that are not held to proper sizes either will not fit into or over the part for which they are designed, or else they will permit plastic material to flow beyond the point desired.

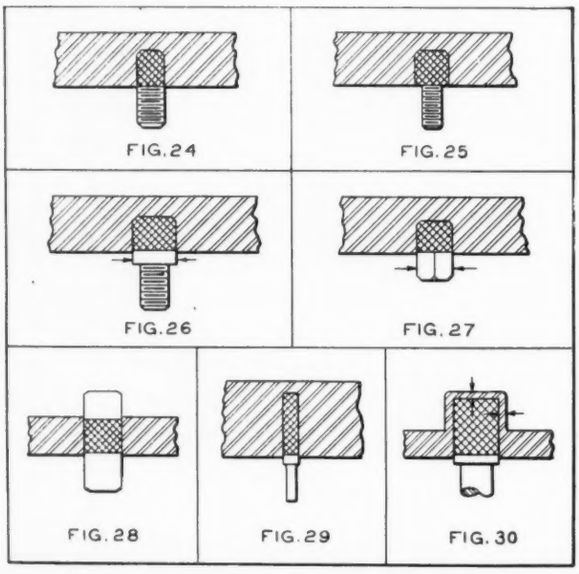


Fig. 24. Avoid Inserts Having Threads without a Shoulder, as the Plastic is Likely to Flow into the Thread. Fig. 25. An Insert with a Shoulder Flush to the Face of the Molding is Better than One without a Shoulder, but may Still Cause Trouble from the Plastic Filling the Thread. Fig. 26. This Insert is Properly Designed with the Shoulder Some Distance from the Face of the Molding. Fig. 27. Projecting Parts of Inserts Should be Cylindrical in Section, as, if They are Some Other Shape—Say Square—the Hole to Support the Insert Usually Must be "Hobbed" rather than Merely Drilled in the Mold. Fig. 28. Inserts that Telescope into Both the Cavity and the Force should be Avoided, as it is Difficult to Keep the Plastic from Flowing into the Hole in the Force, and, if There is Any Lack of Alignment, the Mold may be Broken by the Insert. Fig. 29. The Length of Inserts Extending from the Mold Preferably Should Not Exceed Two and One-half Times the Diameter. Fig. 30. Thin Walls around the Inserts Should be Avoided, as the Plastic is Likely to Crack

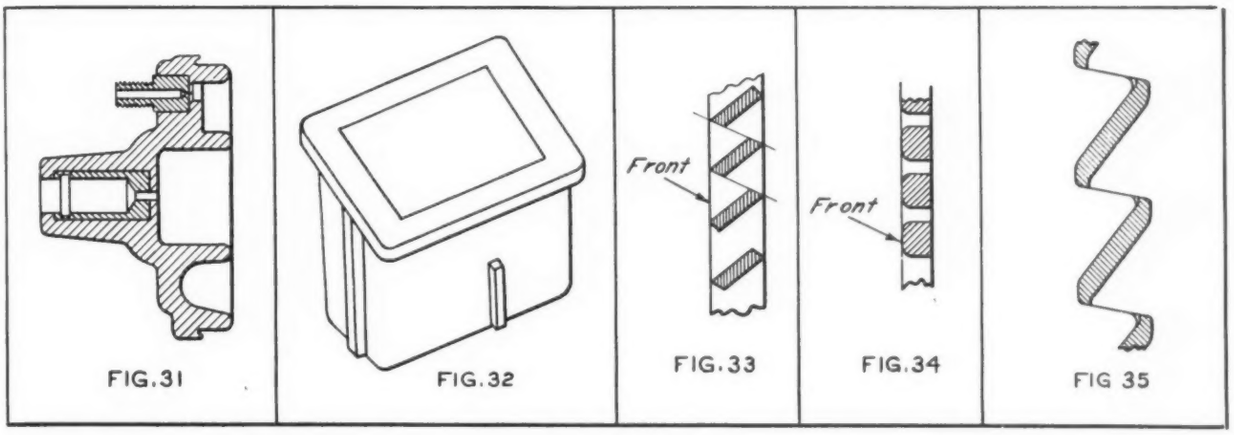


Fig. 31. A Molded Part that Has Two Inserts and is so Designed that Ejector-pins can be Used in Both the Top and the Bottom Portions of the Mold. Fig. 32. A Rib or Boss, as Shown at the Front of This Molding, would Involve an Under-cut in the Mold; if Extended to the Parting Line, as at the End, the Under-cut would be Avoided. Fig. 33. Louvers are Quite Simply Provided in This Manner. The Angle Should Not be Less than 10 Degrees. Fig. 34. Another Way of Making Louvers. The Narrow Openings Prevent the Edges at the Rear, where the Flash Occurs, from being Seen from the Usual Point of View at the Front. Fig. 35. Another Louver Construction. The Flash is Nearly, but Not Quite Horizontal; it is Easily Removed. The Edges Left after the Removal of the Flash Cannot be Seen without Stooping to See the Openings from Below the Normal Eye Level

Internal threads of inserts should always be reamed or redrilled after the tapping operation to insure close tolerances of the minor diameter. All inserts should be free from oil and chips. Figs. 24 to 30 show inserts for molding in place, and indicate how they should and should not be used. Naturally, molded-in inserts must be so placed that they do not interfere with the withdrawal of the molding.

Another example of metal inserts that are surrounded by plastic material is the modern automobile steering wheel. In the past, the molding was usually done on compression presses, using two preforms made to fit the metal insert, which is a spider forming the skeleton of the finished article. But with the advent of large injection molding presses, it has become possible to force the plastic material (generally cellulose-acetate) into the mold and completely around the rim, and it can be made to cover, in addition, part of the spokes, much as in compression molding, but without, of course, using preforms. The metal insert adds strength, and the plastic provides a comfortable grip and insures excellent appearance.

Frequently, it is desirable to press inserts into cored holes rather than to mold them into the part. The inserts should then have "straight" or helical knurls, and, preferably, should be forced into the plastic while it is still hot, provided a shrink fit is desired. This procedure is often cheaper than molding the insert in place, and it also has the advantage of permitting the use of certain shapes of inserts that cannot be molded into the plastic.

Push-out pins may be located either in the top or the bottom portion of the mold. These pins can be operated through or outside of the force, or they can be operated from below, pushing into the cavity. This applies to compression molding in the average vertical press, where the platens, as well as the push-out pins, operate vertically. The most common injection presses, such as are used to mold thermoplastic materials, operate horizontally, and the push-out pins generally are actuated from one end only, in a horizontal direction.

Push-out pins are positively actuated, and for that reason, should have a strong surface to push against, so as not to fracture or puncture the molded part. They should preferably push against ribs or bosses, unless the molding is quite thick at the points where the pins bear on it. These pins invariably leave marks on the molded part (unless they bear on metal inserts) and, for this reason, should be placed where the impressions will be least conspicuous. Quite often the ends of the pins are provided with insignia, numbers, letters, or other identification marks which are reproduced on the molded piece.

Since the designer of the part does not often design the mold, he may not know where the push-out pins will be located unless he consults the molder, as he should do. Usually, however, it is better to indicate on the drawing which surfaces must be free of push-out pin marks than to leave this to the molder, and later find that the marks come on the part at places where they are objectionable.

Hollow pins or tubes are sometimes used for push-outs around fixed core-pins for slender parts. These should be avoided, if possible, as they are likely to produce cracks through which plastic may enter and cause sticking and possible breaking of the pushed-out molding.

Whenever possible, a part should be so designed (see Fig. 31) that push-out pins can be used in both top and bottom halves of the mold. This gives the mold designer a choice which, in some cases, it very helpful. It also is possible to have both top and bottom push-outs which, especially in a multi-cavity mold, is a decided safety factor against loading and closing a mold in which some already molded part inadvertently has been left unseen by the operator.

Location of Ribs and Bosses Relative to Parting Line

Ribs and bosses are used extensively to give sufficient strength and stiffness to the finished part, and at the same time, make the adjacent walls comparatively thin, thus effecting economy in material and molding time. Naturally, the ribs should also be as thin as the walls, if possible. Sometimes they taper away gradually, contributing to the streamline effect and promoting ease in molding and finishing, besides making for a pleasing appearance. When inserts are used, it is good practice to surround them with a boss, and sometimes to add ribs to the boss. This results in a stronger anchorage, and helps to avoid excessive localized stresses.

Ribs and bosses must be so designed and so placed as not to interfere with the ready ejection of the part from the mold (see Fig. 32). For this reason, it often becomes necessary to extend bosses or ribs on side walls as far as the parting line, even though this is not required for other reasons. Interior side wall ribs or bosses, such as are generally employed in radio cabinets, have to be extended from the parting line to the bottom of the cabinet. Such ribs must have draft at each side, as well as in depth, so as to clear the mold or force and not interfere with ready ejection.

Louvers and How They are Formed

Whenever an opening (such as a louver) is desired in a molded part, there is always some attendant flash at the opening. If the flash has to be removed from a frail rib, or where scraping or filing is done in an inaccessible or conspicuous place, there is either danger of damaging the part or the possibility of making it unsightly. Figs. 33, 34, and 35 illustrate various methods of obtaining good results when such openings are to be provided. It is best to design openings where flash occurs in such a way that the removal of the flash can be done readily and without leaving a clipped edge, which is likely to be noticed in service.

Convenient Fastenings

It has become common practice to provide for molding integral studs, projections, or recesses in the molding so that a "speed" nut or clip can be slipped over the projection, or into the recess, to fasten two or more parts together. If the nut is to be permanently secured, the projection is generally circular in cross-section; but if the projection is of "D" or similar section, the nut can be removed by turning it so that the locking tongues of the nut clear the stud. As such integral studs are likely to be rather brittle and easily broken, there should be a liberal fillet where they join the body of the molding.

A stronger fastening results if a metal stud or insert is used, but the stud need not be threaded if a speed nut is to be applied over it. One form of speed clip designed to fit into molded recesses is now available, and makes a stronger fastening than one involving an integrally molded stud. Still other forms of speed clips are available for special types of fastenings, as, for example, fastening a plastic knob to a shaft or spindle. Some convenient fastening means are shown in Fig. 36.

Moldings can be fastened together, or parts of other materials can be fastened to moldings, by drive screws or self-tapping screws. Holes for such screws can be cored if the holes are not too small nor too deep (provided they are so located that coring is feasible), but small holes are commonly drilled. The hole diameter should be such that the screw will not split the plastic. Tubular rivets are sometimes used advantageously in fastening plastic parts together or to metal parts. Projections or studs formed integrally with thermoplastic moldings are sometimes cupped at the end, and, after being passed through a hole in the mating part at assembly, are heated enough to cause the plastic to flow and effect a fastening, somewhat the same as if the parts were riveted.

Dimensional tolerances cannot be given definitely, because circumstances so often alter the rules. Among the factors affecting dimensional tolerances are the following:

1. Kind of material used. Not all materials have equal dimensional stability. The following typical materials vary in the order named (from the most stable to the least): (a) Phenolic, heat-resistant; (b) phenolic, low-loss; (c) polystyrene; (d) phenolic, general-purpose; (e) phenolic, acid- and alkali-resistant; (f) urea; (g) acetate-butyrate; (h) cellulose-acetate.

2. Humidity and temperature variations. In this respect, the materials generally change

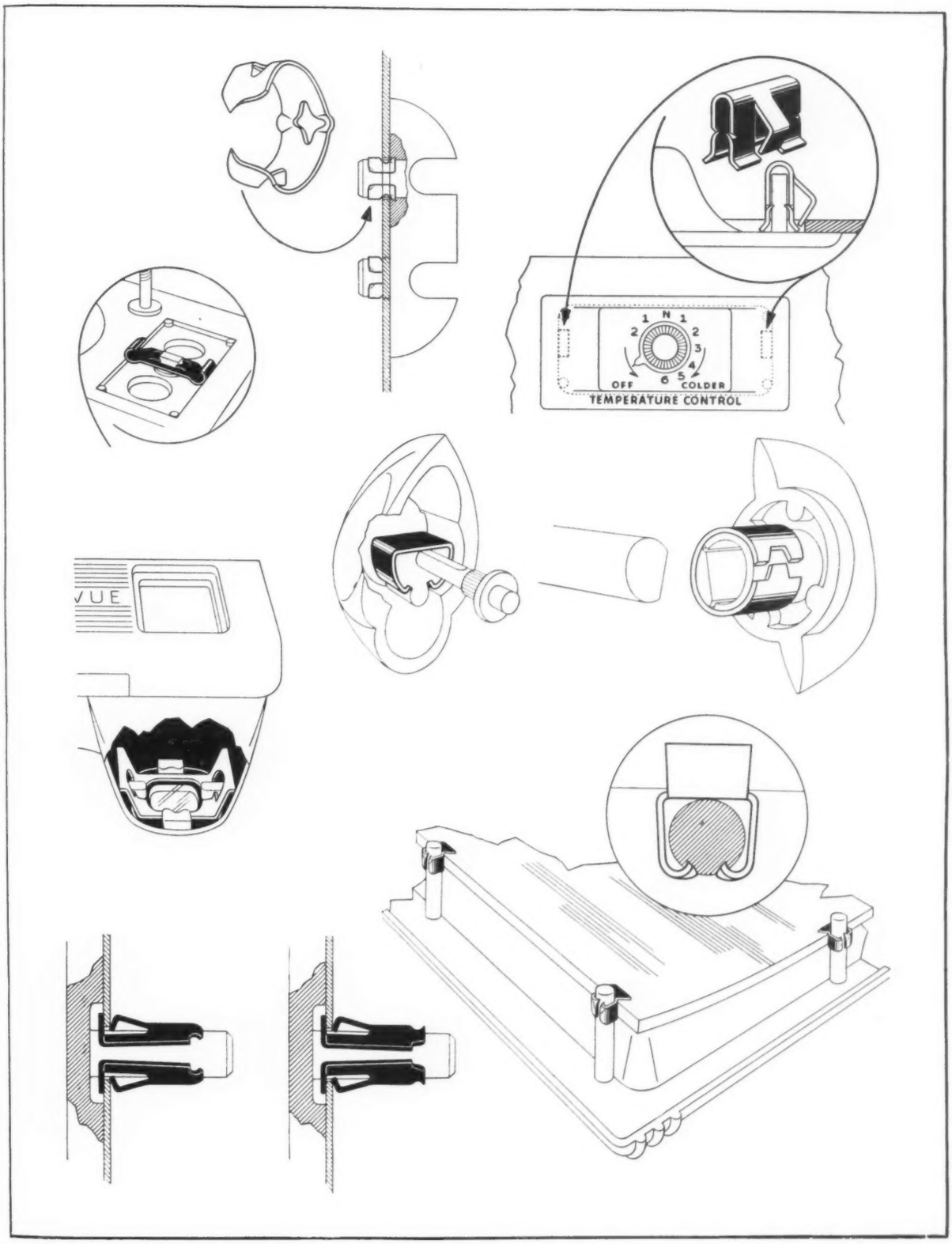


Fig. 36. Types of the Patented Timmerman "Speed Clips" Used for Fastening Plastic Moldings together or to Mating Parts. (Upper Left) Clip with Prongs Gripping a Rectangular Stud in Molding. (Upper Center) Clip Fitting Circular Studs in Molding and Attaching it to Metal Wall. (Upper Right) Clip with Four Sharp Barbs Gripping Projecting Stud in Molding, and Spring Ears to Hold Molding in a Hole. (Center Left) Clip that Fastens a Lens to a Molded Part. (Center Right) Molded Knobs with Spring Clips for Fastening to Shafts. (Lower Left) Tubular Clips Slipped into Holes in Metal Panel Gripping Molded Stud. (Lower Right) Molded Studs with Pronged Clips Having Ears to Hold a Glass Plate

their size and shape in about the same order as just outlined.

3. Conditions under which the materials are molded, such as variations in temperature pressure and time cycle used in molding.

4. Condition of the material prior to the actual molding. Material that has been exposed to excessive humidity or to extreme temperature variations has to be "normalized" before molding; otherwise the moldings will not have dimensional stability.

When all of these factors are considered, it is evident that unvarying rules cannot be given. It is unwise to specify tolerances that are closer than absolutely necessary in any case. Costs are likely to be reduced if tolerances are made as wide as conditions permit. If conditions make close tolerances essential, the molder should be consulted and the tolerances should be made such that he can hold them in the molded part.

Another factor that enters into close tolerance specification is the fact that extreme care or unusual conditions have to be met in tooling or molding, or in both. Sometimes special fixtures are required, and when these or special gages are necessary, they have to be made and maintained. When moldings must be inspected and handled with abnormal care, costs are increased. "Wear and tear" on the mold also affects dimensions. If the mold parts become worn so that the specified tolerances can no longer be held, these parts have to be repaired or replaced, often at considerable expense.

Whenever material of good dimensional stability is specified and all necessary precautions are taken, holes of approximately 1 inch diameter or smaller can be held within plus or minus 0.002 inch or less. Larger openings and general dimensions of parts not exceeding a few inches over all can often be held within a 0.005-inch tolerance. On larger pieces, tolerances should not be closer than plus or minus 0.001 or 0.002 inch per inch. These tolerances apply as between integral parts of the mold. Larger tolerances are likely to be required when the measurement is across parting lines or between mold parts that have a relative motion.

"Creep" or Cold Flow of Molded Parts

Whenever a molded part is subjected to heavy stresses in service, the possibility of "creep" or cold flow should not be overlooked. Cold flow occurs when a sustained, and especially a heavy, load is imposed upon the molding. This causes distortion with consequent change of dimensions. Plastic materials differ greatly in their resistance to cold flow, and the same general type of material often shows variations.

Thermoplastics, in particular, are subject to cold flow; the softer the grade, the greater the cold flow is likely to be. Soft grades of thermoplastics usually contain a higher proportion of plasticizer than the harder grades. Many plasticizers evaporate with aging; the loss of the plasticizer usually results in shrinkage and may cause warpage or even cracking. Hence, dimensions that are within the required limits when the molding is shipped may change subsequently for various reasons. This emphasizes the point that it is often futile to specify close dimensional tolerances in the first place.

* * *

Thorough Training Makes the Difference Between Success and Failure

An example of the importance of thoroughly training workers for the task they are to perform, even when relatively simple, is provided by the experience of a British munitions factory. The work to be done was the hand-soldering of seams in shell fuse cases. After the factory had lost most of its experienced people engaged in this work, inexperienced workers were employed who were given hasty instructions by the foreman. The result was that the weekly output fell to about 1000 good parts, with several thousand rejections. After the same workers had been thoroughly trained by experienced teachers, the output rose to 20,000 cases a week, passed by the inspectors.

In another instance, coil-winding operators with thorough, careful instruction reached, in five days, a standard of proficiency that previously, with haphazard instruction methods, had taken five weeks. Also, there was a 65 per cent increase in the average output, and the rejection percentage was reduced from 5 to 2.

* * *

Eye Accidents in Industry

According to figures compiled by the American Optical Co., Southbridge, Mass., industrial eye accidents during 1941 cost American industry approximately 9,500,000 man-days. There was an increase of about 1,000,000 lost man-days, as compared with 1940. It has been stated that 98 per cent of the 300,000 eye injuries that occurred during the past year could have been prevented. The direct and indirect cost of these accidents has been estimated at approximately $200,000,000.

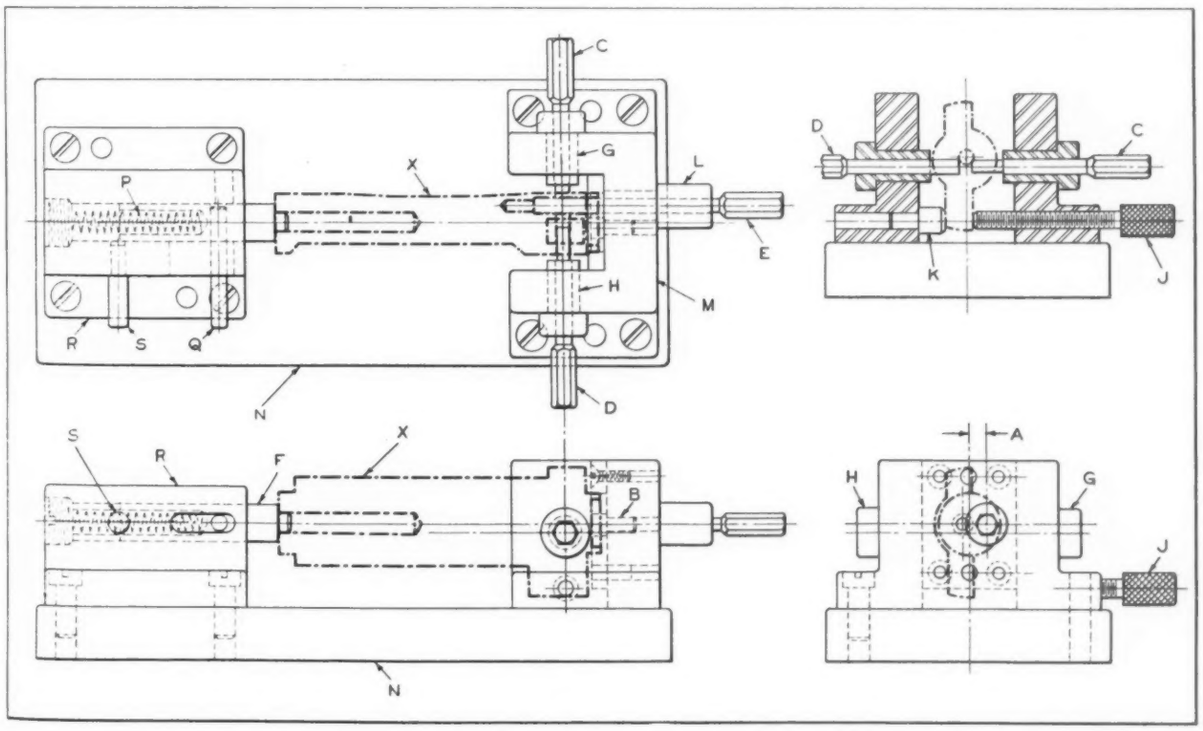
It is also said that the increase in eye accidents is out of proportion to the number of new men employed, therefore the men entering industry should be carefully instructed how to avoid such accidents. Employers and employes must cooperate in preventing accidents of this character.

Gage for Checking Eccentric Location of a Hole

The gage shown in the accompanying illustration was designed to solve the rather interesting problem of checking the location of the cross-hole at the right-hand end of piece *X*, shown in heavy dot-and-dash lines, and the off center position of the hole checked by pin *E*, or its position with respect to the longitudinal center line of the piece.

This fixture is of the bench type, the major feature of interest being the use of several slide-pins. Part *X* has two wing members at the right-hand end. The cross-hole is located just below the center line at the same end. In addition, there is a blind hole at the left-hand end and a hole that is off center an amount equal to *A* in the right-hand end.

With pins *C*, *D*, and *E* removed from the fixture, the inspector pulls pin *F* to the left and places the work in the position shown, with the reduced end of pin *F* in the hole in the work and the counterbored end of the work pressing against the head of pin *B*. Pin *C* is then inserted through bushing *G* and into the hole in the



Gage in which Slide-pins are Used to Check Eccentric Position of Hole in Winged Part

work. Pin *D* is also inserted through bushing *H* in the same manner. This checks these holes for minimum diameter and position with respect to the counterbored surface, there being a slight taper on the pins to facilitate centering the work from the holes.

Next, the inspector very carefully tightens screw *J* against the work. In this position, the work should be in contact with pin *K*. While doing this, pins *C* and *D* are moved to make sure that there is no cramping of the work, which would indicate that the holes were not in proper radial location relative to the wing-shaped members. The last procedure serves to check the location of the hole at the right-hand end of the work that is off center an amount indicated at *A*. This checking is done by having pin *E* pass through bushing *L* and enter the hole in the work.

All of this testing equipment, with the exception of pin *F*, is contained in block *M*, attached by screws and dowels to base *N*. The features of the left end of this gage are the pin actuated by spring *P* which forces the pin into the work, and pin *Q*, employed to move pin *F* in or out of the hole in the end of the work. Pin *Q* in retaining block *R* serves to retain the members in their assembled positions. In moving pin *F*, the inspector places his finger and thumb over pins *Q* and *S* to provide a better clamping grip. Gages of this type require careful handling by the inspector, and are generally used after the work accomplished by individual machining operations has all been completely inspected.

H. M.

Locating Holes with Gage-Blocks and Indicator

By PAUL J. ADRIAN, Saginaw, Mich.

A method recently devised and used for locating holes in jigs, fixtures, and die-cast dies in the Dow Plant, Midland, Mich., is shown in Fig. 1. As there were many holes to be located and no jig boring machine available, a set of gage-blocks made by the writer, a "Last Word" indicator, a Van Norman milling machine with a vertical spindle, and a special locating block *A* were employed for this work with good results. The work on which the holes are to be laid out and drilled is clamped on the milling machine table square with the ways and spindle, the same as when using a jig boring machine. The indicator is held in a drill chuck on the machine spindle, a holder *B*, Fig. 1, being used to facilitate locating the indicator in the correct position.

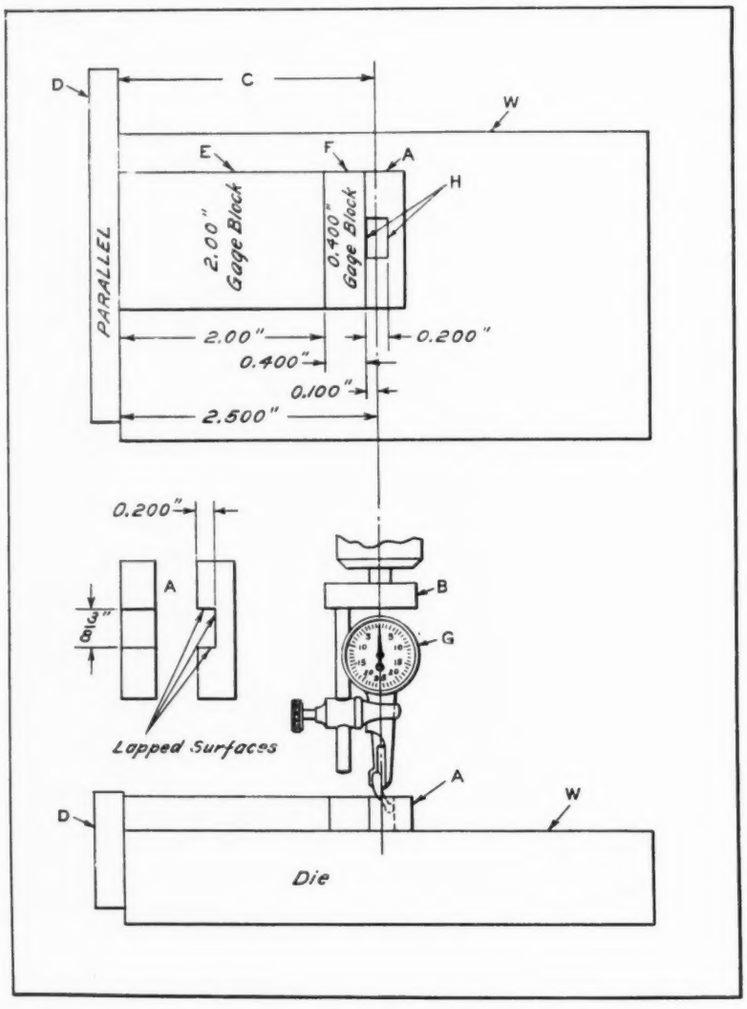


Fig. 1. Method of Using Gage-blocks and Indicator on Milling Machine for Drilling and Boring Hole 2.500 Inches from End of Work W

Assume that a hole is to be drilled a distance *C* of 2.500 inches from the left-hand end of the die *W*. A parallel *D* is first located as shown, against which gage-blocks *E* and *F* are positioned. These blocks have a total length of 2.400 inches. The special block *A*, with a lapped recess 0.200 inch deep in one side, is stuck or "rung" on the end gage-block *F*. One-half the width of the rectangular opening formed by blocks *F* and *A* is equal to 0.100 inch. Thus, when the contact point of the indicator *G* is brought into contact with the sides of the recess and the machine table is adjusted until the indicator shows the same reading at points *H*, it is obvious that the center of the milling ma-

chine spindle is 2.500 inch from the end of the die, as required for drilling the hole. The table is, of course, locked after being positioned, and a final reading of the indicator is taken to make certain that the setting has not been changed by the clamping action.

If the hole must also be located accurately from one of the sides, the same procedure is followed, using the transverse movement of the table and checking the final reading after clamping or locking the table. The hole is then precision-bored in the usual manner.

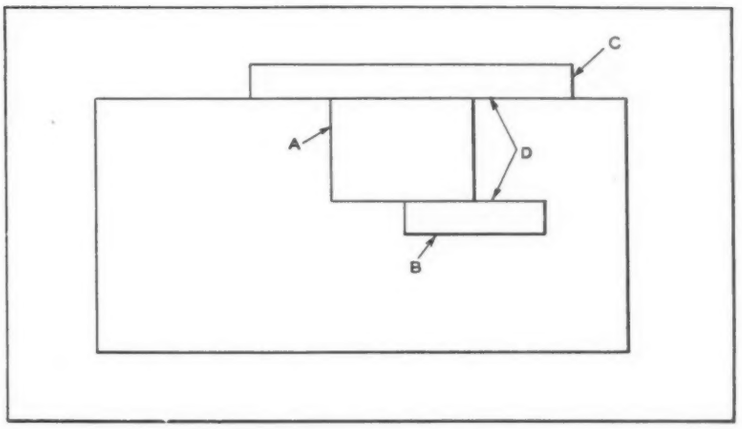


Fig. 2. Method of Using Gage-blocks to Locate Hole Close to One Side of Work

When a hole is to be bored a given distance from, but close to one side of the work, say 0.500 inch from the edge of the work, a gage-block or gage-blocks *A*, Fig. 2, of double this dimension, or 1.000 inch, a block or parallel *B*, and a parallel *C* are arranged as shown in Fig. 2. The indicator is then used as described, the correct setting being obtained when the indicator shows the same reading with the contact point in contact with either of the surfaces *D*.

The procedure described is original with the writer, who would be interested to know if the same process of jig boring has been used by other machinists.

General Electric Has Trained More than Fifty Thousand War Workers

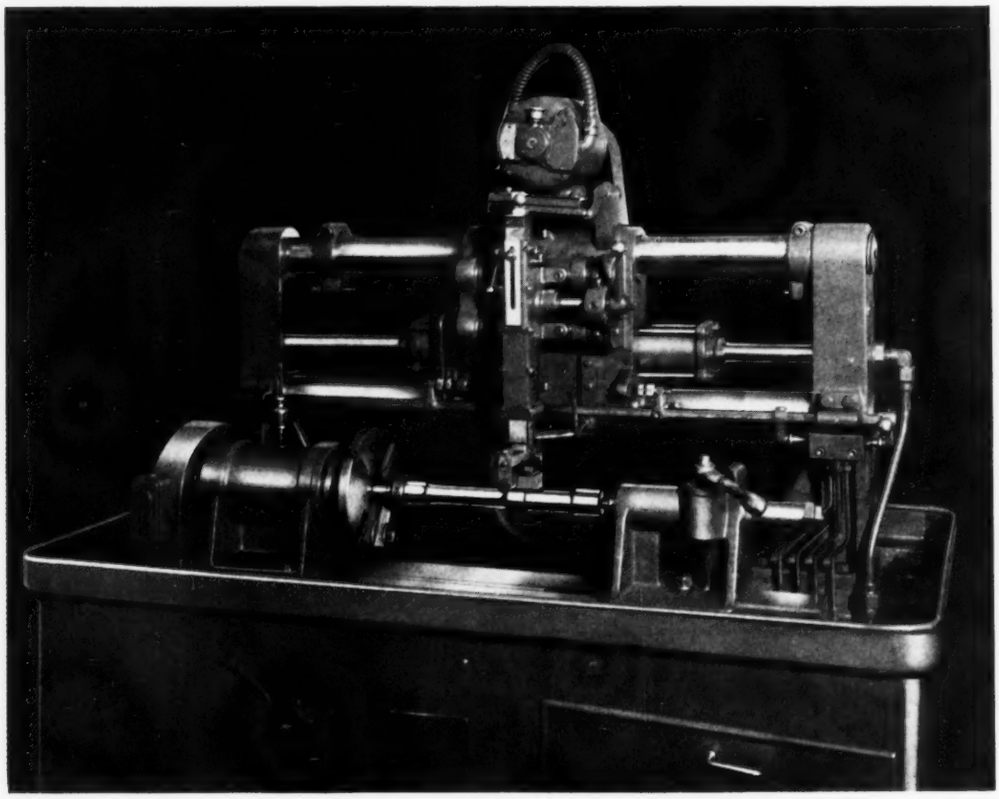
IN the last eighteen months, the General Electric Co. has trained more than 50,000 new employes for war work and placed them on regular production work. Almost every peacetime occupation is represented among these new workers. Many of those who are showing the greatest aptitude in war production have had little or no previous factory experience. Thus, for example, a former orchestra leader now operates a huge planer in one of the company's plants. This man recently received an award for suggesting a better way to do a certain job. An ordained Baptist minister works six days a week on war work and on Sunday conducts the services in his church. Restaurant chefs run turret lathes and screw machines, and an insurance salesman is turning out parts for marine turbines.

In one plant, a former head waitress now supervises a dozen girls making magnetos for fighting planes. In the same shop, nine men and women with no previous shop experience are running lathes. The jig borer—the finest precision machine in the shop—is operated by a former farmer; asked if he had ever operated machine tools before, he replied: "Nothing but a cultivator."

Mr. Pfeif, who has been in charge of personnel work since 1912, says: "Some farm boys have made very good machine operators, and we are especially pleased with the showing of the young men and women from both city and country who grew up during the depression years. They work hard, they are ambitious; I think they are as good as any age group that I have known."

The General Electric Co. also, at this time, is training 1600 young men in its regular apprentice courses; but to augment this, while new plants and additions to old plants are being built, the employes who are to work in them are trained for special operations. Men who will work in a new airplane equipment plant in the Middle West are now being trained at two General Electric plants in New England. Girls who will assemble small motors in a New York State plant now under construction are learning their jobs in classes being conducted in an abandoned garage. All are being paid while learning. Six weeks of instruction qualifies the new worker to begin many of the simpler forms of machine work, but the length of the training varies with the character of the job and the aptitude of the individual.

Baldwin Locomotives for Long



Second Installment of an Article Dealing with the Modern Methods Employed by a Century Old Concern in Building Steam and Diesel-Electric Locomotives

By AMOS G. COLE, Works Manager
The Baldwin Locomotive Works

OPERATIONS performed in the production of parts for Diesel-electric locomotives at the Baldwin Locomotive Works, Eddystone, Pa., were described in the first installment of this article, which was published in April MACHINERY. The concluding installment describes another operation on Diesel-engine parts and typical operations involved in building steam locomotives.

Some of the smaller precision parts required in Diesel-engine manufacture, such as the fuel nozzle, parts of the fuel injector mechanism, and air starting check valves, are finish-machined in a room that is maintained at a constant temperature. One of the machines in this room is the Foster Superfinisher seen in the heading illustration engaged in superfinishing a cylindrical surface on a main bearing bolt. Connecting-rod bolts to mate the holes that are drilled and reamed in the operation shown in Fig. 7 in the preceding installment are superfinished by this equipment to within 10 to 20 micro inches of specified dimensions. The connecting-rod bolts are 14 inches long by 1 3/8 inches in diameter. Three portions of these bolts are superfinished, two of them for a length of 1/2 inch, and the other for a length of 3 1/4 inches.

The superfinishing machine is constructed with a hydraulic cylinder by means of which the abrasive head is reciprocated over the surface being superfinished at the rate of about 360 strokes a minute. The maximum stroke is 3 1/4 inches. While the head reciprocates, the work is revolved in contact with the abrasive stone at a speed of 600 R.P.M. Abrasive stones, 1 inch in cross-section by 2 inches long, are used.

Hauls and Switching Service

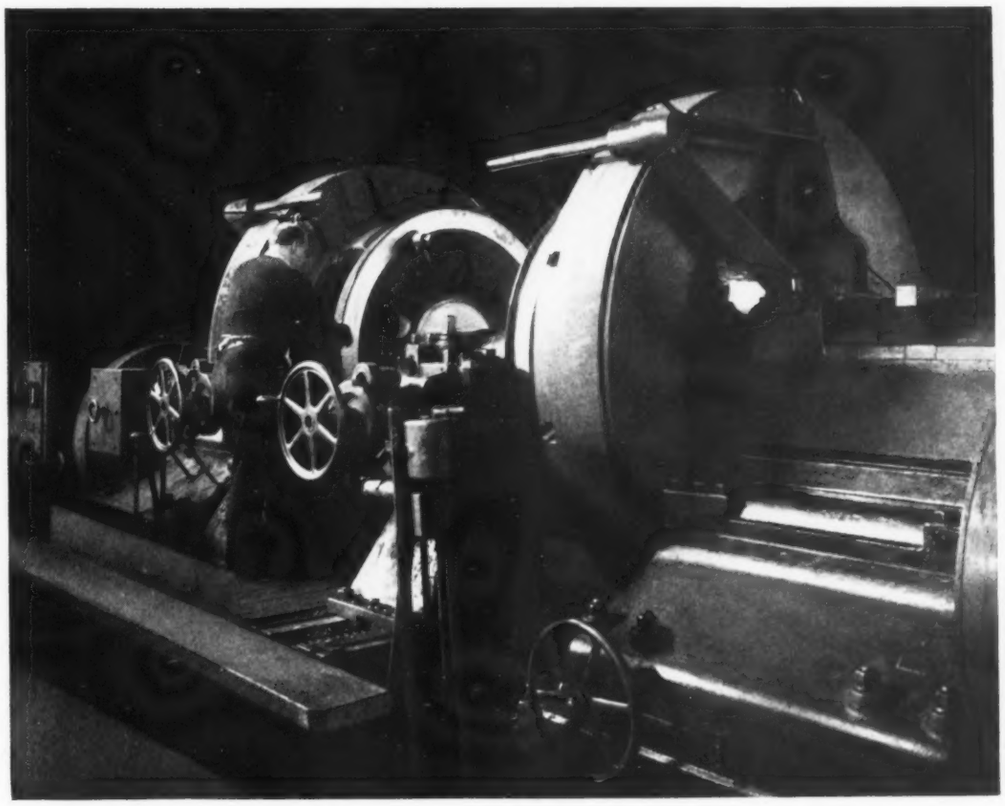


Fig. 9. Wheel-turning Lathe Employed for Facing the Sides of the Tires and for Finish-forming the Treads

Light lubricating oil is brushed on the work to aid the operation.

In Fig. 9 is shown a Sellers wheel-turning lathe engaged in turning the tire treads on a set of driving wheels and facing them. The tires are rough-turned at another Baldwin plant, and are finish-turned by this machine to insure concentricity with the axle. Form cutters are employed, two wheels being turned simultaneously by cutters mounted on two slides, as in conventional railway practice.

Fig. 10 shows a Niles quartering machine which is used to bore wheel centers ready to receive the crankpins. Later, after the crankpins have been assembled, they are finish-turned in this machine to suit the side-rod bushings. Following regular practice, two turning tools are mounted on a head which revolves around the stationary crankpin and, at the same time, is advanced over the crankpin. When the crankpin has been finish-turned, rollers are substituted on the tool-head, as shown in the illustration, and the crankpin is burnished to a hard, smooth surface. The quartering machines are of a duplex design, which enables the crankpins of both driving wheels in a set to be operated upon simultaneously in performing the turning and burnishing operations.

The cellar fit is being planed simultaneously in eight driving-boxes by the Niles planer seen in Fig. 11. The set-up of the work on this machine is facilitated by the provision of two long angle-plates which locate the boxes from the sides. The tops of the boxes rest directly on the planer table.

Many steel sheets required in tender and cab construction, and similar work, must be bent along the ends. Long sheets used in building tenders are bent on the Baldwin-Southwark 800-ton press brake shown in Fig. 12. This press is operated by four hydraulic cylinders. The length of the punch ram is 18 feet.

X-ray photographs are taken of many castings and welded sections to guard against failure of locomotive parts after engines have been placed in service. To expedite the taking of X-rays, the portable General Electric unit shown in Fig. 13 was purchased. This equip-

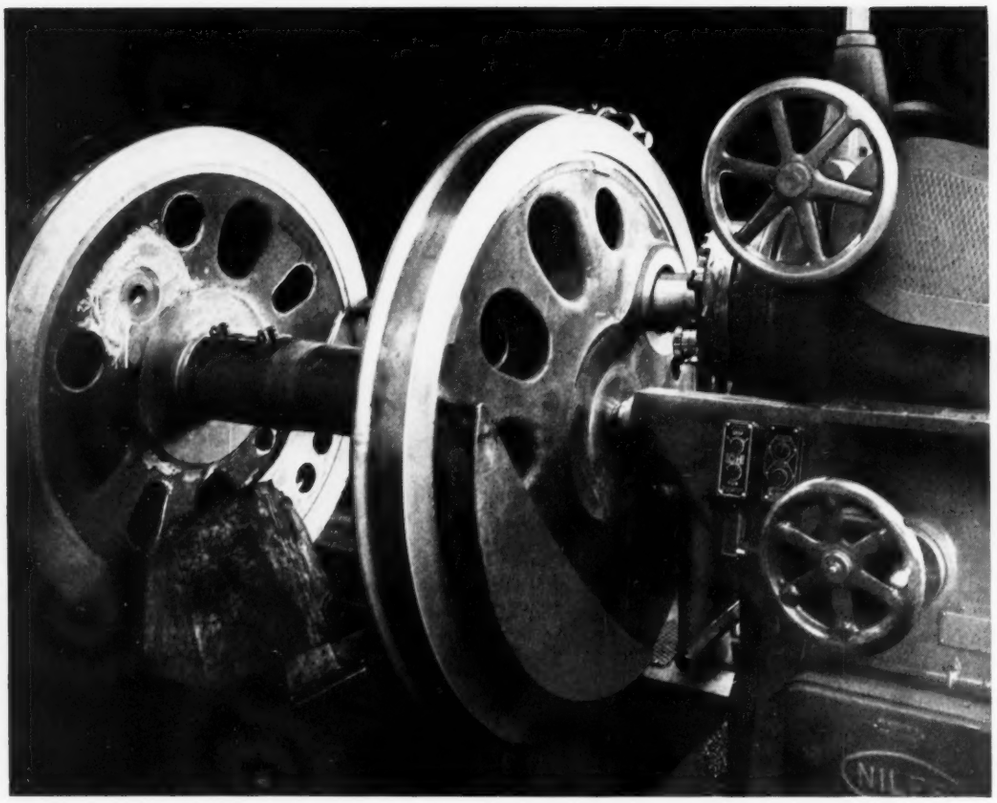
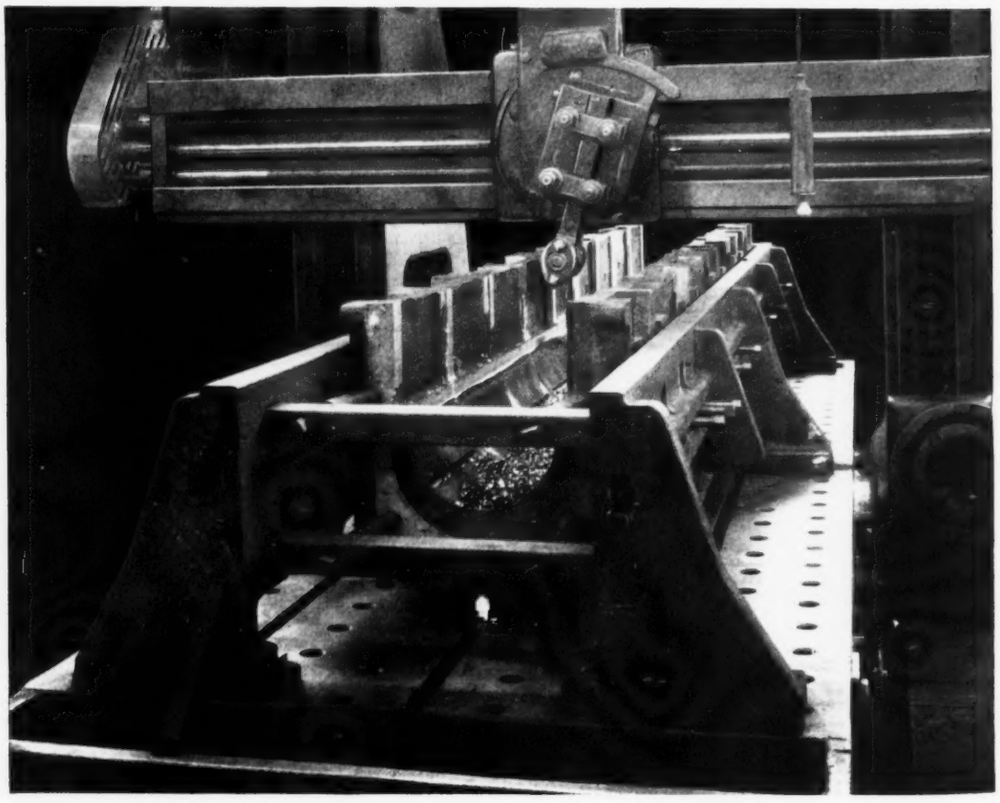


Fig. 10. (Above) Quartering Machine that is Used for Finish-turning the Crankpins after They have been Assembled in the Wheel Centers, and Also for Burnishing Them. Fig. 11. (Below) Planing the Cellar Fit in Eight Driving-boxes Simultaneously



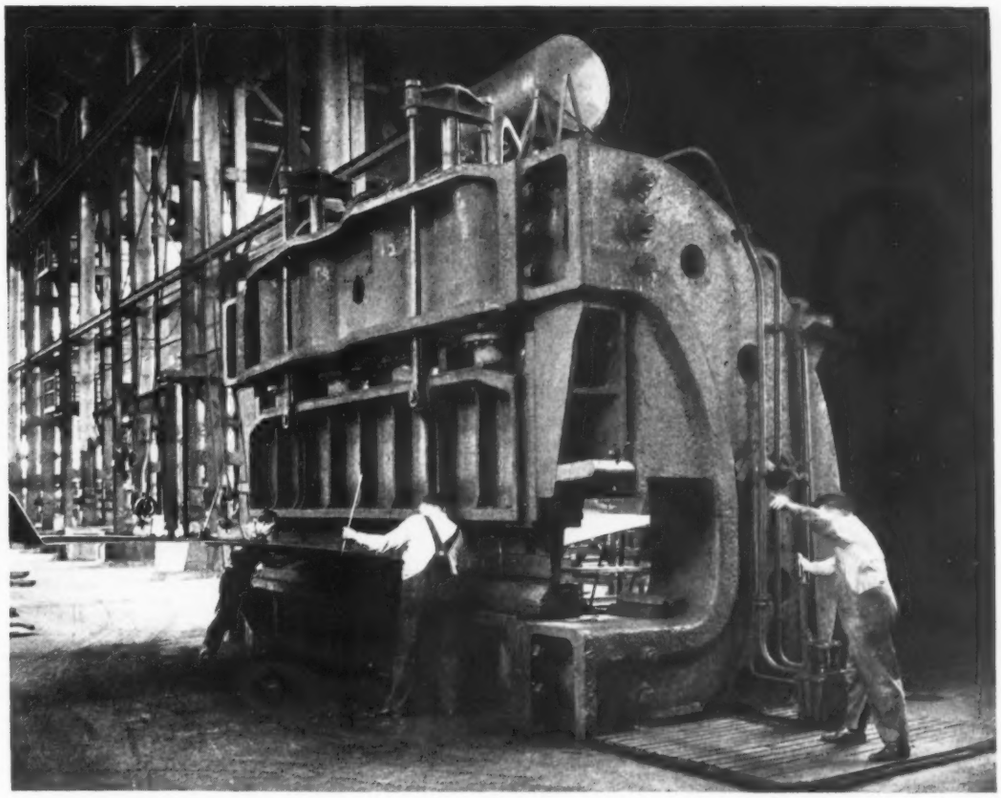
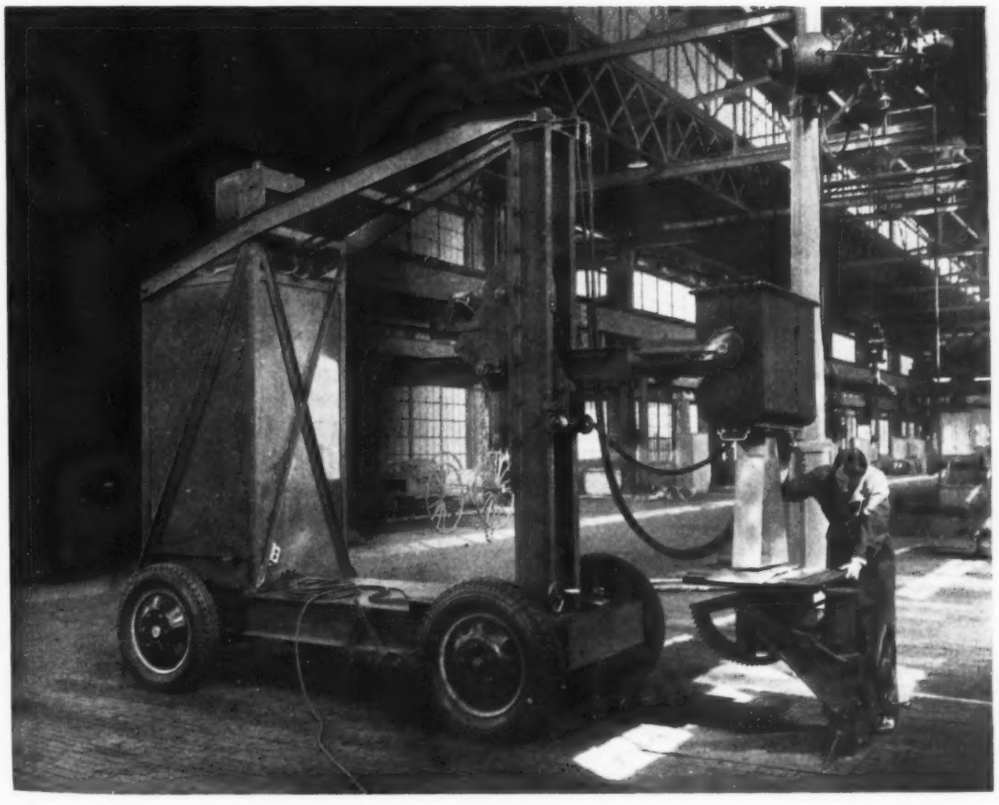


Fig. 12. (Above) Hydraulic Press Brake of 800 Tons Capacity Used for Bending Ends and Sides of Long Plates for Tenders

Fig. 13. (Below) Portable X-ray Equipment that can be Taken from Job to Job when Work is Too Bulky to Take to the Machine

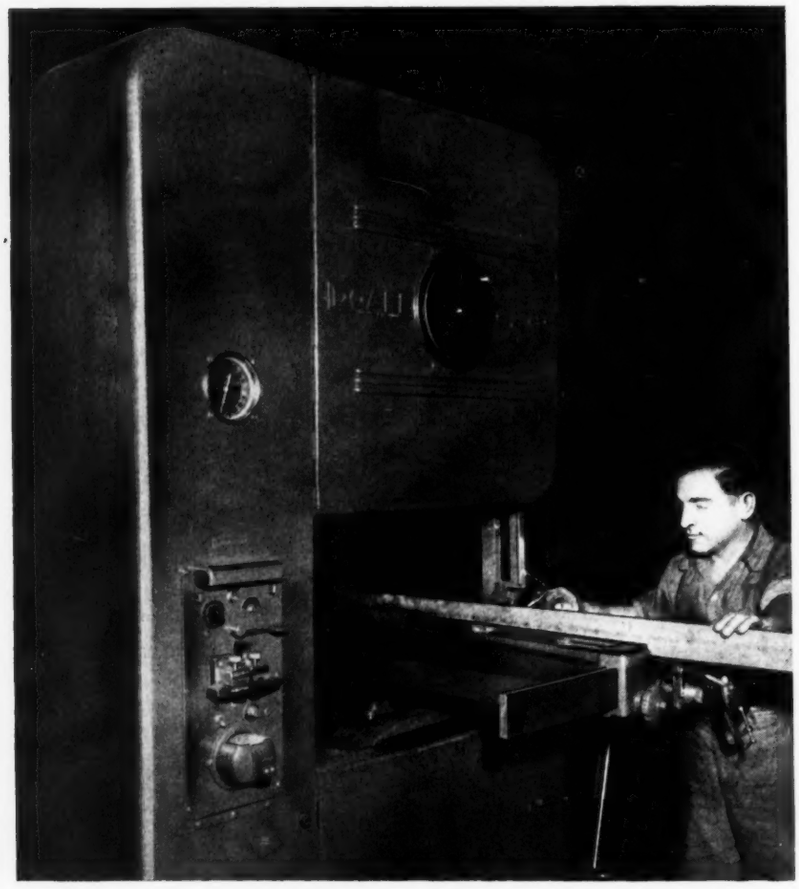


ment can be taken quickly to any department in the shop for X-raying work that is too large for convenient transfer to an X-ray room. The illustration shows welded sheets being X-rayed while lying on a small Cullen-Friestedt positioner. Parts such as castings and weldments that require to be X-rayed at several angles can be readily and conveniently handled by the use of this positioner.

* * *

Sawing Long I-Beams into T-Bars for Ship Construction

A machine that finds extensive use in the sheet-metal shop of the Cramp Shipbuilding Co., Philadelphia, Pa., for cutting out many of the smaller irregular-shaped pieces required in ship construction is the DoAll sawing, filing, and polishing machine shown in the accompanying illustration. In the particular operation illustrated, this machine is being employed for cutting special T-bars from long I-beams for use as stiffeners aboard ship. Two of these special T-bars are obtained from each I-beam.



Sawing, Filing, and Polishing Machine Cutting Long I-beams into T-bar Stiffeners of Special Width for Use in Shipbuilding

Product Improved by the Use of Substitute Materials

Another example of how American engineers made a better product with alternate materials and new designs when war requirements compelled a reduction in the use of metals and other vital materials was pointed out recently at the Northeastern District meeting of the American Institute of Electrical Engineers in Schenectady. Herbert DuVal, Jr., General Electric radio engineer, told how the use of aluminum in two-way radio equipment has been reduced 57 per cent, and similar reductions have been made in the quantity of steatite, copper, rubber, and other strategic materials. In spite of these reductions, the use of other materials and new designs have actually improved the performance of the two-way radio equipment now being manufactured by the General Electric Co., he explained.

Most people, DuVal pointed out, think of the word "substitute" as meaning something less desirable, inferior, or ordinary. Few people, he said, associate the word with better performance or better quality. Yet in this case, that is what the word means.

For instance, in eliminating certain aluminum parts, including trimmer capacitors and IF cans, and employing powdered-iron core transformers, not only was the selectivity of the receiver of the two-way radio equipment improved, but the ease of tuning as well. At the same time, the price of the equipment has been reduced.

* * *

Oil Dermatitis Preventive

Industrial dermatitis, or skin infections, caused by bacteria in cutting oils and similar compounds is said to be prevented by an odorless, water-soluble germicide in tablet form made by the Natriphene Co., Book Bldg., Detroit, Mich. The tablets are dissolved at the rate of one tablet per gallon of emulsified oil base or compound, and added to the cutting oil base before dilution with water. They are dissolved in alcohol before adding to a paraffin base oil. The germicide is claimed to prevent odors and decomposition of oils by preventing or retarding bacterial growth.

Tables for Gear Ratio and Speed Problems

14,000 GEAR RATIOS. By Ray M. Page. 404 pages, 8 1/2 by 11 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York. Price, $5.

This new book contains about 14,000 two-gear combinations and millions of possible four-gear combinations. The tables are presented in both common fractional and decimal forms, and are divided into four main sections, each of which is arranged to facilitate the solution of different classes of ratio and speed problems.

Section 1—Common Fractional Ratios and Decimal Equivalents—This section is composed of 119 separate tables, each complete on one page, with the denominator of the fractional ratio serving as an index. These denominators range from 2 up to 120, inclusive. Each common fractional ratio is followed by its decimal equivalent. For example, the decimal equivalent of 7/27, is in the table having 27 as the denominator. Opposite 7/27 is the equivalent, 0.259,259,259,26. The decimal equivalents have been carried out to eleven places when the ratio is less than 1, and to nine places when the ratio is greater than 1.

Section 2—Decimal Ratios, Their Logarithms and Equivalent Pairs of Gears—The tables in this section contain in the first column ratios expressed as decimal fractions. All these decimals are arranged in numerical order from the lowest to the highest, so that any value in the table can readily be located. The decimals are followed by their logarithms in the second column. The third column contains the ratios expressed as common fractions. When a given ratio has two or more common fraction equivalents, all these are given to facilitate selecting required gear sizes.

Section 3—Total Number of Teeth with Equivalent Gear Pairs and Ratios—The tables in this book apply to all gear combinations having tooth numbers up to 120, inclusive. Section 3 lists, in ascending order, all total tooth numbers from 25 up to 119 + 120, or 239. Below each total number are listed all two-gear combinations equivalent to that total. For example, under "37 Total Teeth" are listed fourteen combinations or pairs of driving and driven gears, each of which has a total of 37 teeth. This section has been arranged for use in selecting "pick-off" or other gears on fixed centers.

Section 4—Numbers and Equivalent Gear Factors—The gear factor table in this section consists of all numbers from 20 to 14,400 that are the product of two factors neither of which exceeds 120. This table is particularly useful in finding gear combinations equivalent to a given numerator and denominator representing a required ratio. For example, if a required ratio $= \frac{1394}{2162}$, the table shows that $\frac{34 \times 41}{46 \times 47}$ is an equivalent of this ratio expressed in practical gear sizes.

These four main sections are accompanied by typical examples showing how the different tables are utilized in obtaining practical gear combinations for precise timing or speed relationship between driving and driven shafts. The examples not only illustrate the use of the tables, but include methods of factoring and "rounding off" odd decimal ratios in cases where the exact ratio may not be obtainable, but a very close approximation is essential. These examples include the selection of change-gears for helical-gear hobbing, both on machines with and without a differential mechanism. This book of ratios may be applied in designing various types of transmissions, including spur, bevel, helical, and worm gearing. With the aid of these tables, it is possible to solve readily ratio problems that otherwise would be very difficult, cumbersome, or impossible.

* * *

"Tuff-Hard" Process for Heat-Treating Tool Steel

A process of heat-treating tool steels so that the amount of material that they can remove per stroke or revolution is considerably increased has recently been announced by the Tuff-Hard Corporation, 5960 Caniff Ave., Detroit, Mich. This process, which bears the name "Tuff-Hard," is available as a service for the heat-treatment of specially designed tools; in the form of processed tool bits of various grades and standard square sizes; and under patent license agreement enabling manufacturers to heat-treat their own tools and such production parts as may require an unusual combination of toughness and hardness.

It has been found particularly effective in improving molybdenum high-speed steels so that they may be used in place of tungsten and cobalt tool steels, with comparable results. The process also can be utilized to widen the range of all steels that can be used for standard performance.

This process was developed through some 15,000 recorded time studies, resulting in patentable improvements in method and equipment, and utilizes highly accurate time and temperature controls.

Gear Manufacturers Review Gear-Cutting Methods

At the twenty-sixth annual meeting of the American Gear Manufacturers Association, held at Hotel Hershey, Hershey, Pa., May 10 to 12, two of the sessions were devoted to a symposium on gear-cutting practice, three of the addresses applying directly to gear-cutting methods, and a fourth covering principles of metal-cutting in general.

John H. Flagg, Newly Elected President of the American Gear Manufacturers Association

"Gear Production by the Hobbing Process" was covered in a paper by Louis W. Falk, of the Falk Corporation, Milwaukee, Wis. In this paper, the author covered comprehensively the various problems to be solved in the efficient application of the hobbing process. He dealt specifically with gears for the automotive field, with small gears cut in quantity, and with large special industrial gears and marine gears. He then referred to the various means available for increasing production at this critical time—improvements in existing equipment, new machines, and improved methods for operating hobbing machines to obtain maximum production. He mentioned how in the plant with which he is connected, all of the important gear-hobbing units are now operating from 600 to 675 hours a month.

G. H. Sanborn, of the Fellows Gear Shaper Co., Springfield, Vt., spoke on "Cutting Gears and Other Parts with a Reciprocating Generating Tool." In this paper, the author outlined, by means of simple diagrams and other illustrations, the principles of the generating process as applied to gear-cutting machines having a reciprocating cutting tool, like the Fellows gear shapers. This method is applicable not only to gears, but to a wide scope of work outside of the gearing field; it has found a definite and important place in the production of irregular-shaped gun parts, airplane engine cams, connecting-rods, and many other precision machinery parts.

The third paper in the symposium on gear-cutting methods was read by H. E. Kitchen, of the Farrel-Birmingham Co., Buffalo, N. Y.; the subject of the paper was "Cutting Gears in Farrel-Sykes Gear Generators." In it, the author described the Sykes method of cutting double helical gears with continuous teeth—that is, without a space in the center between the right and left-hand helical teeth. He described the machines by which this is done, and explained how cluster gears, angular gears, internal gears, and double helical racks are cut by this method, as well as regular double helical gears.

A paper covering the action of cutting tools and the formation of chips in metal-cutting in general was presented by Dr. E. M. Martellotti, of the Cincinnati Milling Machine Co. This paper, "Physics of Metal Cutting," dealt with the theory of metal-cutting in a very instructive manner. Motion pictures, to a greatly enlarged scale, were presented showing the action of the tool and the chip being removed. The stress distribution when a metal is acted upon by a tool was also shown by means of colored motion pictures of photo-elastic materials.

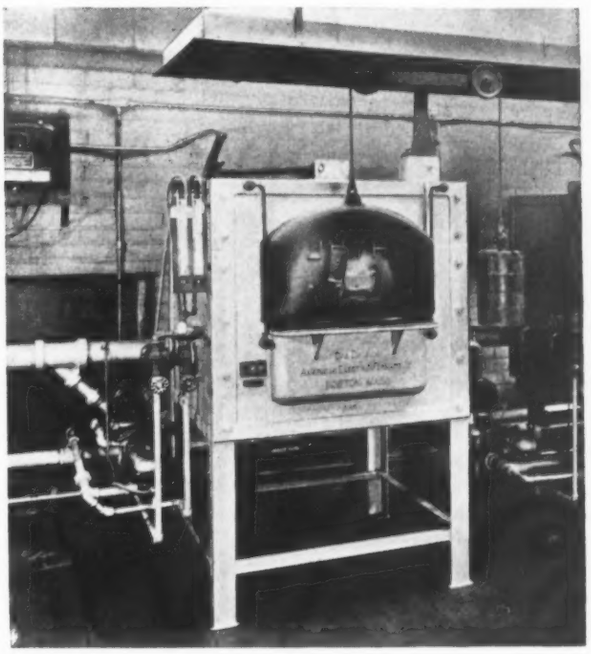
The following new directors took office at the meeting: A. G. Kessler, vice-president, Farrel-Birmingham Co., Buffalo, N. Y.; Douglas T. Hamilton, publicity manager, Fellows Gear Shaper Co., Springfield, Vt.; L. H. Schrade, vice-president, D. O. James Mfg. Co., Chicago, Ill.; Thomas J. Bannan, vice-president, Pacific Gear & Tool Works, San Francisco, Calif., and Western Gear Works, Seattle, Wash.; and W. H. Kinkead, manager, Gearing Division, Link-Belt Co., Philadelphia, Pa.

The following officers were elected for the coming year: President, John H. Flagg, president, Watson-Flagg Machine Co., Paterson, N. J.; vice-president, R. C. Ball, president, Philadelphia Gear Works, Philadelphia, Pa.; treasurer, L. R. Botsai, manager, Gearing Department, Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.; and manager-secretary, Newbold C. Goin, Wilkinsburg, Pa.

Selecting Oven Type Heat-Treating Furnaces

Characteristic Features of Gas and Electric Oven Type Furnaces Used for Heat-Treating Tool Steels and for Various Other Heat-Treating Operations—Second of a Series of Four Articles

By HOLBROOK L. HORTON



Juthe Muffle Type Gas Oven Furnace for Preheating, Hardening, and Annealing

WHERE the requirements of the purchaser include capacity to handle heat-treating operations on a quantity basis, somewhat larger furnaces than those discussed in the preceding article (published in May MACHINERY) will be needed.

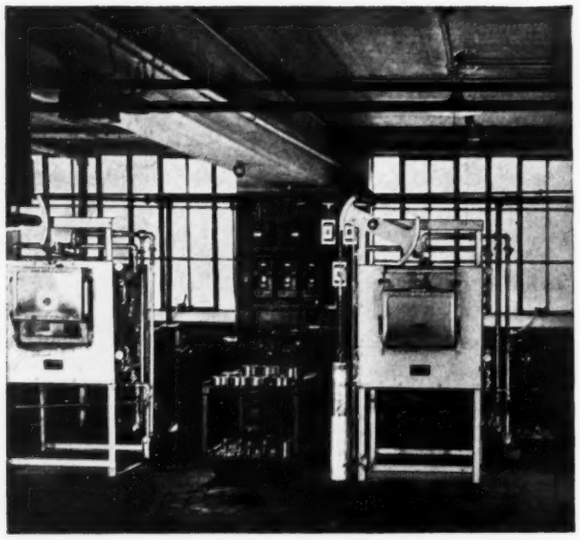
One series of these larger oven type furnaces is of similar construction to the high-speed steel furnace previously described, in which the main burners fire immediately under the arch. In addition to these burners, however, a lower auxiliary set of burners is furnished to assure a uniform temperature from the roof of the furnace to the hearth slab, even though a high and heavily charged box, such as is used in pack-carburizing, is inserted. Both sets of burners are governed by a single-valve gas-air ratio control.

Additional features obtainable are: (1) A special system of control furnished with vestibule burners which closes the vents and forces the products of combustion out through the door opening the instant the door is raised, while the vestibule burners are opened automatically and serve to consume any oxygen which may enter as an eddy current at the bottom of the entrance; and (2) patented atmosphere adjusting burners which introduce gas immediately under the heating burners, the latter being set independently for the most efficient combustion. In this way, an atmosphere which is sufficiently reducing for the hardening of various grades of carbon and high-speed tools is obtainable.

The lining regularly employed in this type of furnace consists of 4 1/2 inches of insulating refractory backed by 2 1/2 inches of block insulation. Sizes range from a 16- by 18-inch entrance with a 16- by 19-inch hearth, to a 36- by 24-inch entrance with a 36- by 40-inch hearth. These furnaces are regularly supplied for hardening, annealing, and carburizing operations, and have a temperature range of from 1300 to 1800 degrees F. Maximum input of the smallest size is about 131,000 B.T.U. per hour, and of the largest size about 472,000 B.T.U. per hour.

Another series of oven type furnaces is of semi-muffle construction and has an expansion feature. The framework is of 1/2-inch cast-iron construction, with ribbed and reinforced sections bolted together by the use of two-way slotted expansion-allowing bolt holes. This construction permits lengthening at any time by the addition of section castings and rebuilding the interior. The lining used is 4 1/2 inches of insulating refractory throughout, with insulating refractory brick backed by secondary, low heat-loss brick in the combustion chamber. These furnaces are furnished in sizes ranging from those with a 6- by 10-inch door opening and a heating space 15 inches long to those with an 18- by 24-inch door opening and a heating space 18 inches long.

There is a series of production type oven furnaces available with under-firing burners for a temperature range of 1200 to 2000 degrees F., and under- and over-firing burners for a temperature range of 2100 to 2600 degrees F. The outside casing is of steel plate and structural steel, reinforced with inside members, and



Gas Oven Furnaces for Heat-treating in Medium Temperature Range, Built by American Gas Furnace Co. Main Burners Fire Immediately under Arch

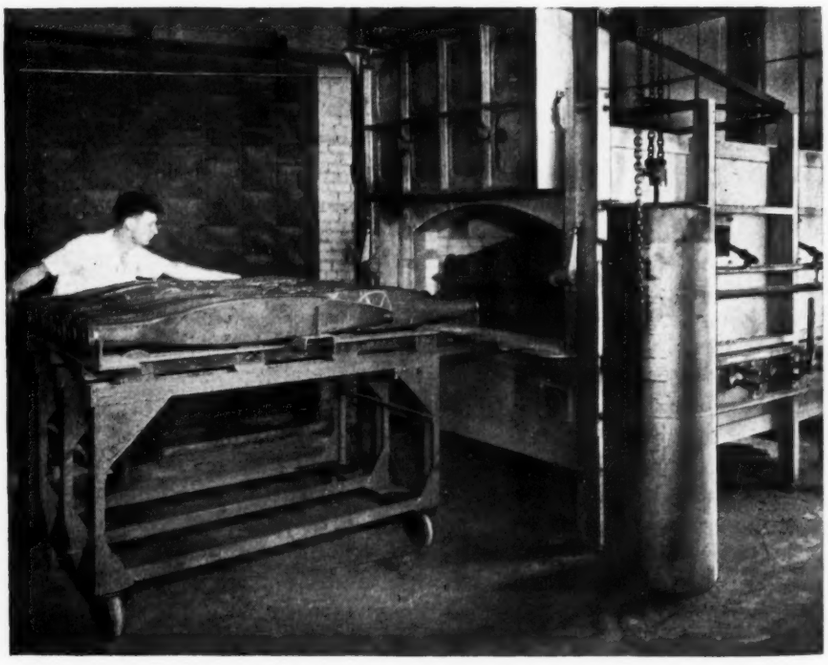
welded throughout. A cast-iron hearth plate and lintel are bolted to the casing.

The lining is 4 1/2 inches of firebrick backed by 2 1/2 inches of insulating brick. The hearth of the under-firing type is hard-burned fireclay tile, 2 1/2 inches thick, with side ledges, and is supported on high-alumina brick piers. The hearth of the over-firing type is of Sillimanite, 2 1/2 inches thick, with side ledges, and is supported on Sillimanite brick. Low-pressure, automatic-proportioning, single-valve burner equipment is furnished. These furnaces range in size from that having a 9- by 6-inch door opening and a hearth 13 1/2 inches long to that having an 18- by 12-inch door opening and a hearth 36 inches long. The low-temperature range furnaces have a maximum input of 128,000 B.T.U. per hour in the smallest size, and 462,000 B.T.U. per hour in the largest size. The high-temperature range furnaces have a maximum input of 208,000 B.T.U. per hour in the smallest size and 545,000 B.T.U. per hour in the largest size.

For tempering, stress-relieving, and other low-temperature heat-treating operations, a series of oven type furnaces is available with a temperature range of 275 to 1250 degrees F. The body has a heavy steel exterior, reinforced with structural members. The interior is of high-temperature brick construction with 6 inches of high-temperature insulation. Controlled combustion is achieved by means of an adjustable back-pressure baffle which maintains the correct combustion-chamber temperature. A high-capacity, heavy-duty alloy fan forces the heated air through the furnace to secure uniform heat-treatment.

Make-up air and recirculating air mix with the products of combustion and are forced into the heat-distributing duct. Recirculating air is taken back to the heater, where it is preheated by passing on the outside of the combustion chamber before mixing with the products of combustion and fresh air. Up to 350 recirculating air changes per minute are provided through the working chamber, depending upon the size of the furnace. The sizes range from that having a 13- by 13- by 13-inch heating chamber to that having a 37- by 25- by 37-inch heating chamber. The smallest sized furnace has a heater capacity of 21,000 B.T.U., and the largest sized one, 82,000 B.T.U.

Another series of small oven furnaces suitable for production use features a special system of firing for low temperatures. Two sets of burners, arranged in tiers, are used. Each nozzle has an independent combustion tunnel, and is manifolded with all the other nozzles of the same tier to an automatic proportioning inspirator; with this arrangement, individual control of each tier of burners is provided.

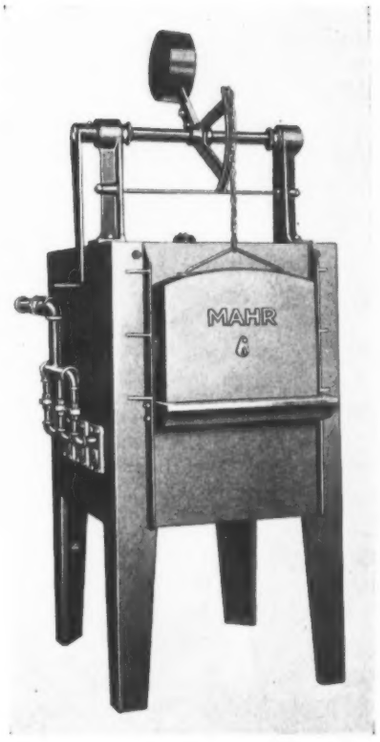


Large Gas Oven Type Furnace Built by Surface Combustion Corporation. This Furnace is being Used for Stress-relieving Forged Solid-steel Propellers

When the furnace is operated at temperatures below 1000 degrees F., one set of burners functions in the usual manner, completely burning a correctly proportioned gas-air mixture in one tier of tunnels. The other set of burners is operated with the gas valve closed and the air valve open to inject auxiliary air into the combustion chamber through the other tier of tunnels. The increased volume at accelerated circulation of the hot diluted gases produces heat transmission by convection and provides the necessary uniform heat for low-temperature drawing operations.

This burner system is furnished only for the furnaces operating at low air pressures—that is, 1 to 1 1/2 pounds per square inch. With low-pressure burners, these furnaces have a temperature range of from 600 to 2000 degrees F. When equipped with high-pressure burners, the temperature range is from 1400 to 2000 degrees F. A cast-iron frame door with steel front and lined with 4 1/2 inches of insulating refractory brick provides a tight brick-to-brick seal. The standard lining is 4 1/2-inch insulating refractory brick backed by 2 1/2 inches of insulating brick. Maximum input is 200,000 B.T.U. per hour in the smallest size, and 400,000 B.T.U. per hour in the largest size.

A high-temperature series of furnaces of similar construction, designed for the heat-treatment of high-carbon and alloy steels, has a maximum operating temperature of 2500 degrees F.; with low-pressure burners, the minimum operating temperature is 1600 degrees F.; and with high-pressure burners it is 2000 degrees F. The hearth is of 2-inch thick silicon-carbide tile, with side ledges, and is supported on firebrick piers. Maximum input is 350,000 B.T.U. per hour in the smallest size, and 800,000 B.T.U. per hour in the largest size. Both the low-temperature and the high-temperature series of furnaces range in size from that having a 12- by 7 1/2-inch door opening and a 12- by 18-inch hearth to that having an 18- by 12 1/2-inch door opening and an 18- by 48-inch hearth.



Tool-room Furnace Made by the Mahr Mfg. Co. which is Available in Under-fired Type for Medium-temperature and Under- and Over-fired Type for High-temperature Heat-treating

Still another series of gas oven furnaces for heat-treating high-speed steel is of the muffle type. The burners are staggered at opposite sides of the furnace, so that the burning gases from each do not meet directly and produce hot spots, but pass adjacent to one another and curl around the muffle before exhausting through vents at the top of the furnace.

The muffle and supporting piers are of silicon carbide, which is used because of its high heat conductivity and mechanical strength

Surface Combustion Corporation's Controlled-atmosphere Oven Furnace Suitable for Heat-treating High-carbon Alloy, Tool, and High-speed Steels

at elevated temperatures. The gas and air for atmosphere control are premixed, the ratio being governed by valves at the mixing chamber and indicated on a double manometer. Excess moisture in gas and air is removed by dehydrating cylinders.

An atmospheric control curtain from a slot type burner extending the full width of the furnace throat provides an effective barrier against the entrance of free air into the chamber, as well as providing the proper atmosphere. A controlled flow of gases in the chamber is achieved by the use of an adjustable vent at the rear of the furnace.

This series of furnaces is designed to operate within a temperature range of from 1900 to 2500 degrees F. The sizes range from that with a heating chamber 8 inches wide by 12 inches long by 5 inches high to that with a heating chamber 16 inches wide by 24 inches long by 12 inches high. Maximum input ranges from about 294,000 B.T.U. per hour in the smallest size to about 535,000 B.T.U. per hour in the largest size.

A series of similar design and sizes operates within a temperature range of 1400 to 1900 degrees F., and is adapted for the hardening, carburizing, and annealing of carbon steel, and the preheating of high-speed steel. Maximum input ranges from about 80,000 B.T.U. per hour in the smallest size to about 160,000 B.T.U. per hour in the largest size.

"Fleet-Fillet" Welding, a New Welding Technique

As a result of extensive study on the part of engineers and research technicians of the Lincoln Electric Co., Cleveland, Ohio, this organization has developed a new technique of arc welding known as "Fleet-Fillet" welding. This method greatly increases the speed with which welds can be made, and radically changes former ideas about speeds in making fillet welds. As a specific example is mentioned the possibility of an arc speed of 65 feet per hour for welding a 3/8-inch horizontal fillet.

Three important advantages are claimed for the new procedure: (1) Faster weld production without increasing operator fatigue; (2) reduction in the amount of welding electrode used per foot of weld; and (3) lower welding costs. Briefly, the method involves (1) the holding of the electrode at a prescribed angle; (2) the use of higher currents; (3) the advance of the electrode at a higher speed; and (4) the use of electrodes recommended for the purpose.

* * *

Thousands of pounds of zinc can be saved for war purposes by using black enameled conduit instead of zinc-coated conduit. Enameled conduit, carefully handled and installed, will give durable protection in most locations.

In recent years, it seems to me too much stress has been put on the rights and privileges of American citizens; too little on the obligations and duties. And I believe it is true that we have clamored too much for more rights, unreasonable ones very often, and have acquired the dangerous habit of slurring over any thought of the obligations as citizens that make the continuance of our rights possible and probable.

I believe we are perfectly capable of settling the social and economic future of this country (whatever form it may take) entirely by ourselves. I believe we are perfectly capable of settling all of our problems far better than any foreigners can settle them for us. But we must do our duty as Americans much more unselfishly than we have been doing it, if we are going to keep the right to run our own show ourselves.

So I beg us all, as good Americans, to subordinate our personal interest a little bit more than we are in the habit of doing —to refrain from exercising our rights too aggressively until we have won this war; and in order to win the war, to think of and perform our obligations as Americans somewhat more sincerely. If each one of us thinks just a little more in this way, he will quickly see that the other man is doing it too. That sort of thinking and living creates the greatest military machine of all — the democratic morale of the Ancient Greeks, of the Romans of the Republic, of the French Revolution, of our own Revolution and of the World War of 1914—the morale that has won more often than any other and must surely win again.—C. A. Moore, Chairman of the Board, Manning, Maxwell & Moore, Inc.

Meeting of Metal Trades Association

THE forty-fourth annual convention of the National Metal Trades Association, held at the Hotel Biltmore, New York City, May 19 and 20, was attended by leading executives in the metal-working industries from all over the United States. Many important addresses were made before the meeting. One session was devoted to a panel discussion featuring the subject "How We Train for National Production," in which five executives of well-known companies took part.

Roe S. Clark, Newly Elected President of the National Metal Trades Association

S. B. Taylor, works manager of the Reliance Electric & Engineering Co., led the discussion and also dealt with instructor training. Paul E. Heckel, executive assistant of the Cincinnati Bickford Tool Co., spoke on executive training, while William L. Dolle, president of the Lodge & Shipley Machine Tool Co., covered the subject of foreman training. Apprenticeships were discussed by K. R. Wood, factory inspector of the Union Special Machine Co., and the training of specialists was dealt with by William A. Ruhl, works manager of the Universal Winding Co.

Among the addresses before the convention should be mentioned: "How to Supervise to Build Morale," by Dr. Donald A. Laird, Rivercrest Laboratory, Middle Haddam, Conn.; "Production in the Aircraft Industry," by J. Carlton Ward, Jr., president, Fairchild Engine & Airplane Corporation, New York City; "Employer-Employe Cooperation," by J. E. Moody, plant manager, Hat Corporation of America, South Norwalk, Conn.; "Wage Negotiations," by C. J. Uhlir, director of industrial relations, National Metal Trades Association, Chicago, Ill.; and "How to Set Up and Operate a War Production Board Joint Labor-Management Committee," by George A. Seyler, vice-president, Lunkenheimer Co., Cincinnati, Ohio, and John B. Goss, director of planning, Scovill Mfg. Co., Waterbury, Conn.

Roe S. Clark, of the Package Machinery Co., Springfield, Mass., was elected president; H. H. Kerr, of the Boston Gear Works, Inc., North Quincy, Mass., first vice-president; and George A. Seyler, of the Lunkenheimer Co., Cincinnati, Ohio, second vice-president and treasurer.

One of the Applications of the Portable Dynetric Balancer Developed by the Westinghouse Electric & Mfg. Co. In This Balancer a New Sensitive Metering Element Eliminates the Amplifier Formerly Needed and Reduces its Weight by Half. The Illustration Shows the Balancer in Use at the Westinghouse East Pittsburgh Works, where Several of Them are Employed in Analyzing Vibrations of Motors, Generators, and Other Machines Running at Speeds as Low as 100 R.P.M.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Direct Blackening Process for Copper and Copper Alloys

A simple process called Ebonol "C" for blackening copper and copper alloys has recently been developed by the Enthone Co., 442 Elm St., New Haven, Conn. The process involves immersion in a solution of blackening salts operated near the boiling point, or from 200 to 212 degrees F. The blackening is accomplished in from two to ten minutes, depending upon the alloy undergoing treatment. No electric current is required in the process.

The process is stated to be suitable for blackening copper, beryllium copper, bronze, phosphor bronze, and brasses having a zinc content of 35 per cent or less. High brasses are colored a pleasing chocolate brown. The coating is essentially cupric oxide, and being integral with the base metal, cannot chip or flake off. In addition to being jet black, the coating is hard enough to be buffed, and does not require lacquering to prevent wear, as is the case with copper sulphide type finishes. An unusual feature is that the finish can be heated to almost a dull red heat without flaking, and continuous exposure to temperatures as high as 700 degrees F. causes it no injury. 201

Synthetic Material for Isolating Vibration and Shock

Manufacturers who have heretofore relied upon rubber as a medium for "deadening" or isolating vibration in their products are now forced to look elsewhere for substitutes to take the place of this restricted commodity. A material designed specifically for the absorption of shock and vibration and used successfully for this purpose over a period of years is the synthetic compound "Keldur," manufactured by the Keldur Corporation, 420 Lexington Ave., New York City.

This compound resembles rubber in appearance, but has somewhat different properties. Thus, although highly resilient, it is subject only to slight compression under load or changes in intensity of impact. When used as a machine support, the actual amplitude of vibration may not exceed a few thousandths inch. It is also characterized by a pronounced time lag in recovering its original thickness after compression, thus providing a marked damping effect.

It is manufactured in sheets about 3/8 inch thick, with an embedded open textile on both faces. It does not oxidize nor harden with age, but retains its resilience indefinitely when properly installed. It is not attacked by oils, alcohols, esters, or gasoline and petroleum products. It is slowly attacked by concentrated mineral acids and alkalies. Keldur is also affected by water and steam, but protection can be obtained in the form of a waterproof flexible paint or by a lead foil which affords protection against sulphuric acid, when such exposure is anticipated.

Keldur is customarily used as a supporting pad in one or more thicknesses under the machine or piece of equipment to be isolated from vibration. 202

Substitutes for Aluminum Paints Made Available

A line of five new paints, designed to provide civilian markets with products to replace now unavailable aluminum paints, has been developed by the American-Marietta Co., 43 E. Ohio St., Chicago, Ill. These paints are suitable for both new construction and maintenance applications, and can be applied by brushing or spraying.

Valdura Tank White has been introduced to replace aluminum paint in applications where it is desirable to cut evaporation losses and to reduce inside temperatures. It has a reflectivity factor 10 to 15 per cent higher than aluminum paints, and is resistant to oil and water.

Valdura Metal Lead provides a protective, lead-colored metal coating for all metal surfaces, including new or old galvanized metal. Metallic lead provides a leafing action similar to that of aluminum, affording a coating highly resistant to acids and alkalies, and to fumes, rust, and moisture. It will set in two to three hours, will dry in ten hours, and resists temperatures up

To obtain additional information about materials described on this page, see lower part of page 166.

to 225 degrees F. It can be used as a general metal primer under all paints except those containing asphalt.

Two Valdura Defense Grays, available in light and neutral shades, are designed to provide low-cost effective protection and long durability on exposed metal surfaces. Both colors have high gloss finishes, and are resistant to rain, sun, grime, smoke, and rust.

Valdura Enamelized Yellow Metal Primer is designed for all types of metal surfaces, particularly where the metal is subjected to extremely damp, wet, or foggy conditions. It can be used under water when covered with one or two coats of Defense Grays. Its light yellow color permits the use of a single coat of paint of any other desired color to hide the primed surface. 203

Solvent Cleaner for Pressure Type Metal-Washing Operations

Grease, oil, and dirt can be removed from all types of metals with the aid of Quaker Quasol No. 80, a solvent suitable for use in pressure type washing machines, developed by the Quaker Chemical Products Corporation, Conshohocken, Pa. This solvent is mixed with hot or cold water in the proportions of one gallon to from twenty-five to seventy-five gallons of water, depending upon the difficulty of the cleaning job, and is used at temperatures ranging from 130 to 160 degrees F. It is said to remove heavy coatings of mineral oil more rapidly than ordinary alkalies, and leaves an imperceptible film on the work which acts as a rust preventive. This solvent can be used in cleaning all types of metals without danger of injury to the metal or the worker. 204

Protective Coating for Damaged Tin-Plated Surfaces

A compound for making repairs to damaged tin coatings, known as Amco Metallic Coating Powder, Brand K, has been placed on the market by the American Solder & Flux Co., Trenton Ave. and Norris St., Philadelphia, Pa. The material is intended for use wherever an original tin coating has been damaged in handling, worn away through use, or burned away in a welding operation.

The compound blends with the tin coating; and since it has a melting point lower than that of tin, the original coating is not harmed by the application. A continuous protective surface is formed, presenting an appearance similar to that of tin. Brand K compound is satisfactory for use on those surfaces of food containers that do not come into direct contact with the food itself. It is suitable for all other forms of equipment where damaged tin surfaces require protection. When in contact with iron or steel in a corrosive medium, it is electro-positive, and therefore affords protection against rust and corrosion. 205

Compound Prevents Perspiration Corrosion of Metals

"Ply-Rustex," a cream made by the Milburn Co., Detroit, Mich., is now available for application to the hands of workers before contact with polished metal surfaces, in order to prevent perspiration corrosion and other forms of rust caused by handling metals. In setting up or removing metal parts, a fingerprint may become a source of corrosion, which, although invisible at first, may result in surface damage.

The use of Ply-Rustex cream enables workers to handle polished metal surfaces freely without the use of gloves. This compound forms a protective coating on the skin that is inert with respect to chemicals, oils, cutting compounds, and other materials that may be encountered in industrial processing. It is non-toxic, harmless to the skin, and is easy to apply and remove. Since it forms an impervious coating, it aids in preventing irritations that might result in some form of industrial skin disorder. 206

Penetrating Solvent Acts Chemically to Dissolve Rust

A fast-acting solvent utilizing a new principle, which is said to work twelve times faster than penetrating oil and which turns rust into a grease-like compound, has recently been announced by the distributor, Patrick-McDermott Co., 2706-8 S. Hill St., Los Angeles, Calif. This solvent, known as "Exola," was developed for the sole purpose of freeing metal parts that are rusted or corroded together, and the manufacturers claim that it will free all combinations of metals, irrespective of how badly they may be "frozen."

By combining chemically with the rust or corroded metal, Exola is said to form a metal stearate similar to grease, which immediately loosens the metal parts without harming the metals themselves. Owing to its efficient action and speed of penetration, this product is expected to find wide application in machine shops and factories, as well as in service shops, wherever the need may arise to separate metal parts. 207

To obtain additional information about materials described on this page, see lower part of page 166.

Grinding Coal-Car Wheels Concentric

The treads of wheels for coal cars built in large quantities at the Huntington, W. Va., Works of the American Car and Foundry Co. must be concentric with the journals within 1/32 inch. To meet this requirement, which is checked on every tenth wheel by an inspector of the Association of Chilled Car Wheel Manufacturers, the wheels are ground by the machine here illustrated. This machine was built by the Berwick plant of the American Car and Foundry Co.

In this grinding operation, the wheel unit is revolved on the axle centers on which the axle was supported during turning and burnishing of the journals. The unit is revolved by the motor-driven spindle of the headstock. Two grinding wheels, 30 inches in diameter by 1 3/4 inches face width, which are mounted on motor-driven heads at the rear, are advanced into contact with the car-wheel treads as operators at opposite ends of the machine turn large handwheels. The grinding wheels are then fed across the car-wheel treads as the operators turn the handwheels of cross-slides, so as to grind the treads for a width of 2 1/2 inches at the point where they will actually ride on the railroad tracks.

The practice is to grind until a finished surface is obtained completely around the wheel treads, the actual diameter not being of vital importance. The wheel tread is finished by grinding rather than by turning, in view of the fact that the chilled treads range up to 352 Brinell hardness.

* * *

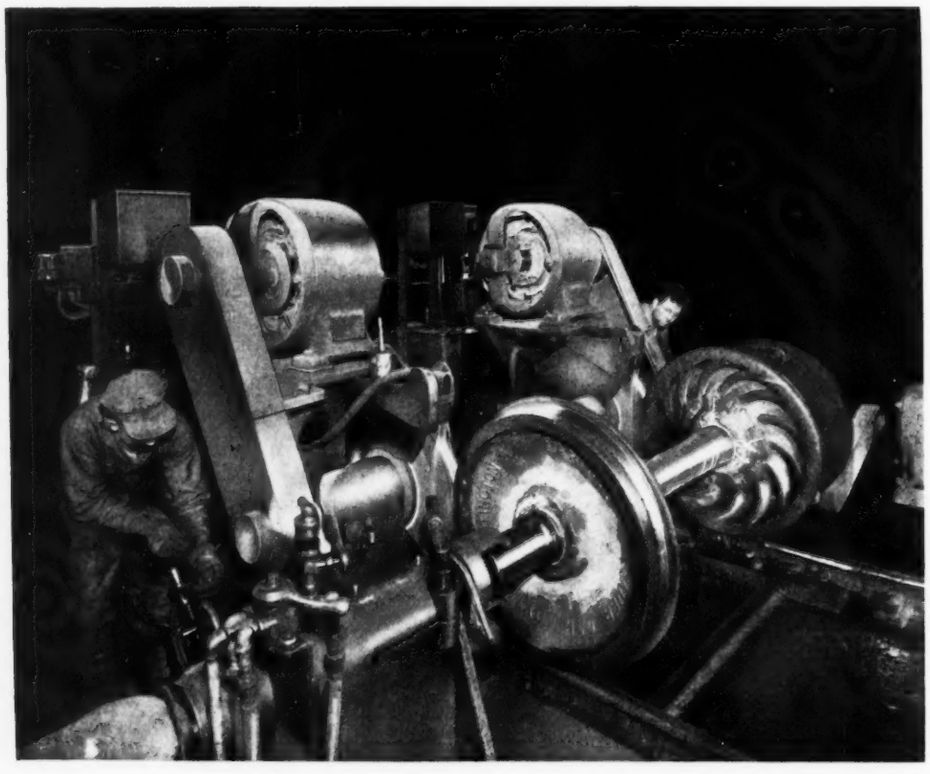
Volume of New Railroad Equipment Greatest Since 1929

The railroads of the United States put over 80,500 new freight cars in service in 1941, the largest number in any year since 1929. During the latter year, the railroads installed approximately 84,900 new cars. In addition, on January 1 this year, the railroads had approximately 75,000 new freight cars on order, the largest number at the beginning of any year since the compilation of these records began twenty years ago.

A total of 633 new locomotives were placed in service in 1941, of which 161 were steam locomotives and 472 electric and Diesel. This was the largest number placed in operation since 1930. There were 546 locomotives on order on January 1 this year, of which 258 were steam locomotives and 288 electric and Diesel.

* * *

The tanks, planes, and other munitions needed to win the war cost vast sums of money. Everyone can have a share in achieving victory by buying U. S. War Savings Bonds and Stamps.



Grinding a Finished Surface Simultaneously on Both Wheel Treads of a Set to Insure Concentricity with the Axle Journals

★

NEW TRADE LITERATURE

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 165 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June Number of MACHINERY

Defense Facilities Survey

JOHN CHATILLON & SONS, 85 Cliff St., New York City, has published two Defense Facilities Surveys — one for its New York plant, where precision springs, scales, and dynamometers are made, and the other for its subsidiary, the Foster Bros. cutlery plant in Fulton, N. Y.—the purpose of which is to present a quick and specific picture of the type of work the company is equipped to undertake on prime contracts and sub-contracts for war work. 1

Ball-Bearing Design Data

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. Booklet DD—first of a series on New Departure Engineering Service, dealing with the details of design of shafts and housings for ball bearings, including such information as proportions and finish of bearing seats; lock-nut threads; recommended shaft shoulders; designing to aid disassembly, etc. 2

Silent Gears

GENERAL ELECTRIC CO., PLASTICS DIVISION, Pittsfield, Mass. Catalogue PC-501, covering two types of non-metallic gear materials—Fabroil and Textolite—made by the company. Suggestions for machining these gears are given, as well as installation data, load and gear specifications, dimensions of gear blanks, and information for ordering. 3

Quenching Oils, Carburizers, Cutting Oils

E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia, Pa. Catalogue entitled "Houghton Products for the Metal Industries," covering carburizers, hardening salts, quenching oils, drawing compounds, cleaners, cutting oils, rust preventives, etc., classified according to their use in various types of munition manufacturing. 4

Care of Diamond Tools

J. K. SMIT & SONS, INC., 157 Chambers St., New York City. Booklet on the care and maintenance of diamond tools, giving useful information regarding the truing and dressing of grinding wheels, instructions on diamond sizes, mounting, coolants, chatter and taper, depth and speed of dressing, etc. 5

Computations for Sheet-Metal Working Operations

E. W. BLISS CO., 53rd St. and Second Ave., Brooklyn, N. Y. Publication containing engineering data for use in connection with sheet-metal working operations. Copies available only to management, engineering, and production executives in the metal-working industry. 6

Air-Operated Presses

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa. Bulletin 276, descriptive of the Chambersburg "Cecostamp," a high-production, air-operated, impact type stamping machine, especially designed to meet the needs of the aviation industry, but applicable also to a variety of short-run work. 7

Induction Heating

INDUCTION HEATING CORPORATION, 389 Lafayette St., New York City, is publishing monthly a series of data sheets covering the subject of induction heating. The first sheet is devoted to the elemental theory. Those interested can obtain copies each month by application to the company. 8

Grinding Machines

CINCINNATI GRINDERS INCORPORATED, Cincinnati, Ohio. Catalogue G-490, illustrating and describing Cincinnati 10-inch plain hydraulic grinding machines. Catalogue G-491, descriptive of Cincinnati 14- and 16-inch plain self-contained grinders; complete specifications are included. 9

DoAll Contour Sawing Machines

CONTINENTAL MACHINES, INC., 1312 S. Washington Ave., Minneapolis, Minn. Booklet entitled "A Chalk Talk on Forty Different Ways to Cut Machining Costs," containing information intended to help operators of DoAll contour sawing machines to get the most out of their machines. 10

Material-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., 1157 E. 283rd St., Wickliffe, Ohio, is publishing a periodical known as the *Cleveland Crane Graphic*, which illustrates and describes many different applications of Cleveland cranes, tramrail systems, and Steelweld presses. 11

Machine Maintenance with Metallizing

METALLIZING ENGINEERING CO., INC., 21-07 Forty-first Ave., Long Island City, N. Y. Bulletin 42A, telling briefly how essential industries are eliminating replacements

and increasing the life of equipment now difficult to replace by the use of the metallizing process.....12

"Fleet-Fillet" Welding Technique

LINCOLN ELECTRIC CO., Cleveland, Ohio. Bulletin 432, entitled "The 'Fleet-Fillet' Welding Technique for Speeding War Production," illustrating and describing a technique of arc welding that greatly speeds up the welding of fillets. 13

War Production Data

E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia, Pa., is distributing a publication entitled "War Production Data from the Houghton Line," containing articles on making cartridge links, heat-treatment of gun tubes, honing practice in gun making, point detonating fuse machining, etc. 14

Precision Collets

PRECISION COLLET CO., 265 Canal St., New York City. Circular containing tables of dimensions and prices of draw-in precision collets for all lathes and millers. The circular lists standard machines using draw-in collets and the number of the collet to use in each.....15

Guide for Selecting Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. New edition of "Quick Selector" catalogue 30-000, designed to simplify the selection of electric equipment, such as safety switches, no-fuse breakers, multi-breakers, panel boards, motor control, and motors.....16

Cylindrical Superfinishing

INTERNATIONAL MACHINE TOOL CORPORATION, FOSTER DIVISION, Elkhart, Ind. Working manual on "Cylindrical Superfinishing," containing complete information on the process, the equipment employed, and methods to follow in order to obtain the best results. 17

Heat-Treating Furnaces

LINDBERG ENGINEERING CO., 2458 W. Hubbard St., Chicago, Ill. Circular descriptive of the Lindberg Super-Cyclone furnace that operates on the principle of 100 per cent forced convection heating with temperatures up to 1750 degrees F. 18

Speed Recorders

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia, Pa. Catalogue N-27, on Micromax speed recorders for measuring and recording the speed of rotating machinery with high accuracy, making possible close speed regulation. 19

Hydraulic Lifts and Elevators

GLOBE HOIST CO., Philadelphia, Pa. Catalogue illustrating and describing various types of hydraulic and mechanical lifts and elevators for industrial use, including the "Tilt-A-Vator" for welding jobs. Typical time- and labor-saving applications are shown.....20

Use of Kennametal Tools

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa. Vest-pocket manual containing instructions for users of Kennametal steel-cutting carbide tools, including the selection, designing, use, brazing, and grinding of these tools. 21

Tool Steel

JESSOP STEEL CO., Washington, Pa. Circular containing information on the analysis, hot-working and heat-treatment of Jessop Washington carbon tool steel, especially suitable for severe tool and die applications. 22

Recording and Controlling Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Catalogue 1105, containing information on the design and operating features of Brown potentiometer pyrometers and accessory equipment. 23

How to Tackle War Business

LYON METAL PRODUCTS, INC., 3253 Clark St., Aurora, Ill. Booklet entitled "How One Company Tackles the War Production Problem," giving the details of how one concern went about obtaining prime contracts and sub-contracts. 24

Presses for Powder Metallurgy

F. J. STOKES MACHINE CO., Philadelphia, Pa. Catalogue 41-T, on Stokes industrial compressing machines for making such metal products as porous bearings, iron gears, valve-seat inserts, contact points, magnets, etc. 25

Cleaning Small-Arms Ammunition

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Treatise entitled "Production Cleaning of Small-Arms Ammunition," published as part of the *Oakite News Service.* 26

Maintenance of Rubber Belting

B. F. GOODRICH CO., Akron, Ohio. Catalogue section 2800, entitled "Care and Maintenance of Conveyor and Elevator Belting — a Guide to Economical Material Handling with Rubber Belts."....27

Tungsten Electrodes

VASCOLOY-RAMET CORPORATION, North Chicago, Ill. Bulletin W-421, containing data on tungsten electrodes for atomic hydrogen welding, including specifications of the full range of sizes.....28

Electric Controls

GENERAL ELECTRIC CO., Schenectady, N. Y. Catalogue GEA-606K, covering commonly used types of controls, including magnetic starters, push-button stations, switches, photo-electric relays, etc. 29

Industrial Pumps

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B6018-B, containing engineering data on Allis-Chalmers "electrifugal" and SS unit pumps, in which motor and pump are designed as one unit. 30

Metal-Cutting Band Saws

SCHULTZ & ANDERSON CO., 176 Ferry St., Newark, N. J. Circular illustrating and describing Johnson metal-cutting band saws, Simplex vises, Speedloy tool bits, and portable demagnetizers. 31

Saws, Knives, and Files

E. C. ATKINS & CO., 402 S. Illinois St., Indianapolis, Ind. General catalogue 22, covering the complete line of Atkins saws, saw tools, machine knives, files, and grinding wheels. 32

Copper Blackening Process

ENTHONE CO., 442 Elm St., New Haven, Conn. Folder describing the "Ebonol C" process for the low-temperature blackening of copper and copper alloys, including bronze and brass. 33

Cutting Oils

GULF OIL CORPORATION, 3800 Gulf Bldg., Pittsburgh, Pa. Booklet on Gulf cutting oils, covering properties and uses, and giving technical data, including cutting speeds, tool settings, etc., for machining various metals. 34

Vibration-Isolation Material

KELDUR CORPORATION, 26 Ave. B, Newark, N. J. Circular describing "Keldur," a vibration-isolation material for reducing vibration, shock, and noise. Specifications and information on installation are included. 35

Dust Collectors

AMERICAN FOUNDRY EQUIPMENT Co., 399 S. Byrkit St., Mishawaka, Ind. Catalogue 82, covering the mechanical features of the Cyclone dust collector, and giving specifications and engineering data. 36

Care of Gage-Blocks

GEORGE SCHERR Co., 128 Lafayette St., New York City. Booklet entitled "The Care of Gage-Blocks," containing information on methods of increasing the usefulness and life of gage-blocks. 37

Cleaning Industrial Floors

MAGNUS CHEMICAL CO., INC., Garwood, N. J. Technical Bulletin 62, describing the methods and materials to use in cleaning all types of floors in industrial buildings. 38

Anti-Corrosive Paper for Wrapping Metal Parts

RIEGEL PAPER CORPORATION, 342 Madison Ave., New York City. Bulletin on oilproof, anti-corrosive papers for the packaging of machined metal parts. 39

Variable-Voltage Planer Drives

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Folder B-3064, descriptive of variable-voltage planer drives with a 30 to 1 speed range. 40

Ampco Punches

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 100, containing case histories covering the use of Ampco expanding punches. 41

Lubrication

SCIENTIFIC LUBRICANTS Co., 3462 N. Clark St., Chicago, Ill. Leaflet on Motor Mica transparent pressure grease, especially recommended for pressure systems. 42

Bearing Seals

STEVENSON ENGINEERING CORPORATION, 45 Willard Ave., Providence, R. I. Bulletin 1, descriptive of the Sealol balanced-pressure, rotary fluid seal for bearings. 43

Patents

INVENTION, INC., Barrister Bldg., Washington, D. C. Booklet entitled "How to Have Your Own Patent Research Department in Washington." 44

Horizontal Pumps

WATSON-STILLMAN Co., Roselle, N. J. Bulletin 270-A, describing high-pressure, motor-driven, horizontal pumps and two-plunger steam pumps. 45

Motor-Driven Industrial Trucks

YARD-MAN, INC., Jackson, Mich. Bulletin descriptive of the "Truck-Man," a motorized industrial truck for moving material that cannot be handled on conveyors. 46

Aircraft Wire and Cable

GENERAL ELECTRIC Co., Bridgeport, Conn. Catalogue illustrating and describing Deltabeston asbestos- and synthetic-insulated aircraft wires and cables. 47

Reamers

JOHN M. ROGERS TOOL CORPORATION, Gloucester City, N. J. Bulletin containing data on Rogers solid adjustable-blade reamers. 48

Wood Sheaves for V-Belt Drives

DODGE MFG. CORPORATION, Mishawaka, Ind. Bulletin A-333, on "Victory" wood sheaves for V-belt drives. 49

Hydraulic Jacks

WATSON-STILLMAN Co., Roselle, N. J. Bulletin 710-A, illustrating

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To Obtain Copies of New Trade Literature

listed on pages 163-166 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

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[SEE OTHER SIDE]

and describing Watson-Stillman independent-pump and outside-pump hydraulic jacks. 50

Small Tools for Aircraft Construction

AIRCRAFT TOOLS, INC., Los Angeles, Calif. Catalogue on small tools for aircraft construction and maintenance. 51

Electric Lighting

GENERAL ELECTRIC CO., Appliance Department, Bridgeport, Conn. Folder describing accessories for fluorescent lighting. 52

Speed Lathes

SCHAUER MACHINE CO., 2062 Reading Road, Cincinnati, Ohio. Condensed catalogue 420, covering the Ideal line of speed lathes. 53

Radiation Pyrometers

BRISTOL CO., Waterbury, Conn. Bulletin P1102, describing a newly developed line of Pyrovac radiation pyrometers. 54

Alternating-Current Welders

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular GES-2704, entitled "Reducing Welding Costs with A-C Welding." 55

Speed-Control Equipment

REEVES PULLEY CO., Columbus, Ind. Folder illustrating three basic Reeves speed control units. 56

Lubrication

NATIONAL GRAPHITE CO., INC., 17 John St., New York City. Circular on the advantages of Konag natural colloidal graphite. 57

Coolant Pumps

GRAY-MILLS CO., INC., 213 W. Ontario St., Chicago, Ill. Circulars on Gray portable coolant pumps for machine tools. 58

* * *

Buick Training Program for Aircraft Engine Mechanics

An intensive training program for ground troops of the Army Air Forces, designed to produce an adequate supply of fully trained aircraft engine overhaul mechanics for the fighting fronts, has been started by the Buick Division of General Motors Corporation, Flint, Mich. The school will be conducted in a Buick service plant which has been converted for the purpose, and will be open exclusively to enlisted personnel of the Air Forces who have been selected by the Air Service Command as a result of aptitude tests. W. F. Hufstader, Buick general sales manager, will be director of the new aviation mechanics' training course. The first class will be graduated in July, and weekly groups of trained mechanics will be turned back to the Army thereafter for the duration of the war.

Plastic Spacers for Milling Machine Arbors

Plastic spacers are now being made for use in milling machine operation to save the brass and steel ordinarily used for such spacers. These spacers are available in ten thicknesses, each with its own identifying color. They are made by Industrial Products Suppliers, 2 Broadway, New York City, from "Plastacele" cellulose acetate plastic, produced by the Plastics Department of the E. I. du Pont de Nemours & Co.

The identification of the thickness of the spacers by color is quite a time-saver, making it unnecessary to measure the spacers each time. The spacers are made in thicknesses of from 0.001 to 0.020 inch, with various hole diameters up to 2 inches. They are provided for use with standard keys. The spacers are said to retain their thickness and finish under all normal working conditions.

* * *

Old machine tools are coming into their own. Many machines that did service in the last war, and that were practically discarded, have been pressed into service again to produce war materials. They are not so efficient as new machines; but when there are no new machines to be had, they help to speed production.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 167-184 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in June, 1942, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 160-161, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in June, 1942, MACHINERY.

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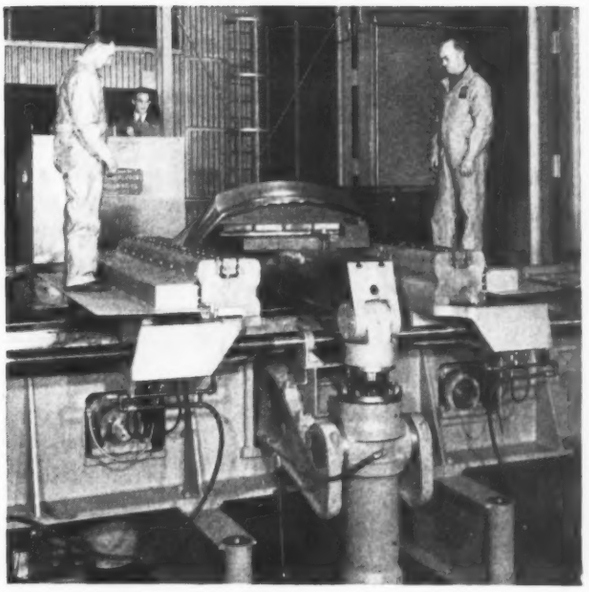
Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News



Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

H-P-M Metal Stretching Press for Forming Large Parts

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has developed a sheet-metal stretching press designed, as shown in Fig. 1, for the production of large formed parts, such as corner sections for bus bodies and sections of flying-boat pontoons like the piece shown on the press in the heading illustration. The two ends of a metal sheet to be formed are gripped securely in clamps, as shown in Fig. 2, while a wooden or metal form or die mounted on a platen directly under the sheet is raised hydraulically, causing the sheet metal to be stretched or formed over the die.

Actually, the die over which the sheet metal is stretched or formed serves as a forming punch, there being no die member such as is used with the forming punch of a die set of conventional design. The elimination of the die member serves to reduce the cost of tool equipment for work of this kind. In some cases, the punch member is made with a formed die cavity, which, in conjunction with a punch held in an overhead structure, per-

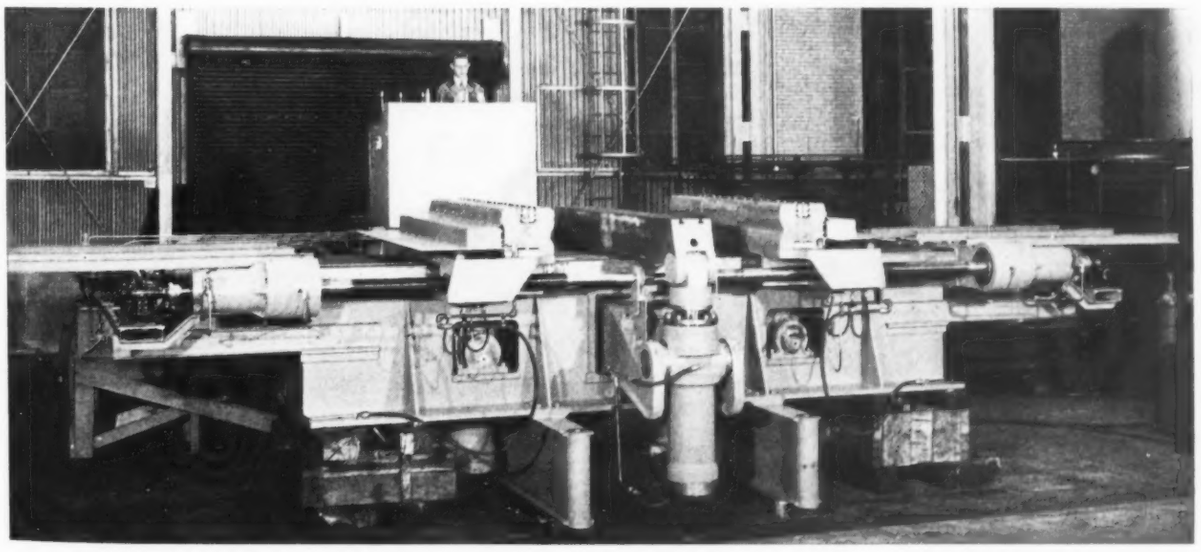


Fig. 1. H-P-M Metal Stretching Press Brought out by the Hydraulic Press Mfg. Co., for Use in Forming Large Metal Parts

To obtain additional information on equipment described on this page, see lower part of page 166.

forms a reverse drawing operation on a comparatively small portion of the metal stretched over the main punch. A spherical depression, for example, can be readily produced at the top of a large formed part or stretched member by an arrangement of this kind.

One of the outstanding features claimed for this press is versatility, its flexibility enabling it to perform stretching work on a great variety of metals, using forming punches or dies of many shapes and sizes. The main platen is 100 inches long by 12 inches wide, and is raised and lowered by means of two double-acting hydraulic cylinders, which have a stroke of 24 inches and a capacity of 150 tons. These cylinders are located, one at each end of the platen, and each can be raised or lowered independently of the other. Also, the main platen can be turned through an angle of 90 degrees, in which position it can be actuated by two similar cylinders inside the press frame, controlled in exactly the same manner as are the ones on the outside of the frame.

The clamping jaws are traversed hydraulically by four double-acting hydraulic cylinders. These cylinders, two at each end of the press, have a total pulling capacity of 21 tons, and provide a stroke of 18 inches at each end of the press. The return lines on these cylinders are piped through two adjustable pressure-relief valves, one for each end; thus, if the use of a particular die necessitates moving the clamp jaws in toward the main platen during a stretching operation, the movement can be controlled through the relief valves.

Four gearmotors are arranged to drive threaded shafts at each corner of the machine for positioning the clamp jaws. Traversing the jaws by these motors permits them to be located at any angle to the main platen up to their maximum angular positions of 15 degrees in the horizontal plane. Each of these threaded shafts has a stroke adjustment of 43 inches. The clamp jaws have a total horizontal stroke of 122 inches. About 36 inches of this 122-inch adjustment is controlled by the hydraulic cylinders and can be used during the stretching operation. The remaining 86 inches of stroke is controlled by the screw adjustment and is used for positioning the jaws. The maximum and minimum distances between jaws are 150 and 28 inches, respectively.

The clamping action of the jaws, which are 84 inches wide, is produced by hydraulically energized toggle joints. To insure adequate gripping action, the face of the toggles against which the metal sheet lies is surfaced with a bead which runs the full length of the jaws. The housing for the clamps is very rigidly and sturdily constructed to insure against the possibility of metal failure.

The press is conveniently operated from a compact control stand on which are located the hand-levers and push-buttons that control the many adjustments required on a press of this type. From this stand, with all the controls practically at his finger tips, the operator can readily see and accurately control the movements of the pressing members. This control is very important, because the quality of finish of the stretched material depends to a large extent on the positions of the various adjustable press members during the stretching operation.

Pressure is generated for the H-P-M open-circuit operating systems by two Hydro-Power radial pressure generators and one Hydro-Power gear pump, all driven by one electric motor. Each of these pumps is part of its own complete operating system, and thus gives individual control to the separate pressing members. Tests have been carried on by the manufacturer of this equipment in which sheet steel was successfully stretched on wooden dies and sheet duralumin was satisfactorily stretched on metal dies. 61

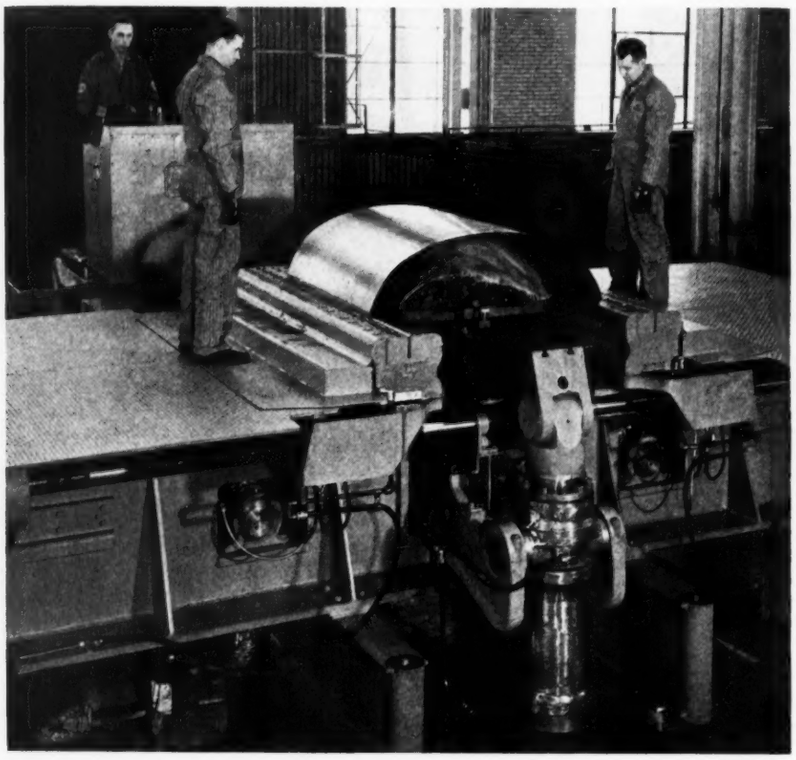
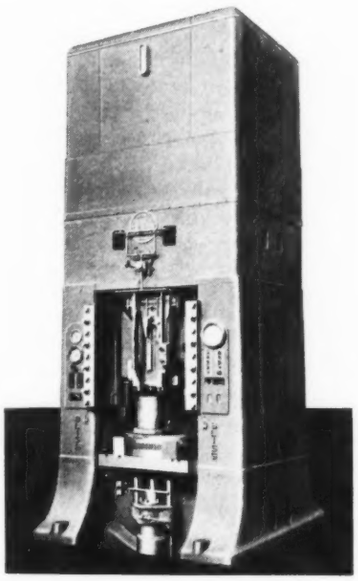


Fig. 2. Stretching Press Similar to One Shown in Fig. 1, with Metal Sheet Gripped in Clamps Ready for Forming

Jessop High-Speed Steel

The Jessop Steel Co., 605 Green St., Washington, Pa., has developed a new product designed TCM high-speed steel to replace 18-4-1 steel. This new low tungsten-molybdenum steel is said to cut as well, if not better than 18-4-1 steel. No change in operating equipment is necessary in using this new high-speed steel because it is heat-treated in the same furnaces and the same atmosphere as 18-4-1 high-speed steel. TCM steel has a slightly lower hardening temperature, which naturally has the advantage of lower heat-treating costs than the 18-4-1 steel. 62

To obtain additional information on equipment described on this page, see lower part of page 166.



Bliss 1500-ton Hydraulic Heading Press

Bliss Hydro-Dynamic Heading Press

Approved for Publication by the War Department

Cartridge cases can be headed at the rate of 250 to 300 an hour, with two pressings per case, on a 1500-ton hydraulic heading press brought out by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. The press shown in the illustration is used for heading 105-millimeter howitzer cases. It is equipped with a two-station pneumatically operated dial feed; a two-station punch-holder, operated pneumatically; a hydraulic ejector, driven by a 7 1/2-H.P. motor; and a hand-operated air hoist. The main pumping unit is of 75-H.P. capacity.

The press is arranged to operate on a fully automatic cycle. When a case is placed in the forward station, pressing the start button will cause the dial to rotate, bringing out the previously pressed case and placing the new case under the press ram. When the dial is in its new position, the press will close rapidly, change speed before contact is made with the work, exert a given predetermined pressure, automatically reverse, and return to its starting position.

The reciprocating punch-holder then operates to bring a second punch into position automatically, and a second pressing cycle with another independent pressure is accomplished. Meanwhile, the ejector rises and ejects the finished case in the forward station during the first pressing, allowing the operator to pick the case off with the air hoist. During the second pressing, the ejector returns to its starting position, permitting the operator to put in a new case.

The entire cycle is fully protected against misoperation. The press ram cannot descend unless the dial and the punch-holder are in the proper pressing position. The dial and the punch-holder cannot operate unless the ram is in the upward position. Another safeguard is a device that automatically prevents the slide from descending if no work is in the press.

The several functions of the press cycle are separated by means of a selector switch, so that the press ram movement, dial movement, and punch-holder movement can be independently operated by the proper push-buttons when the die is being set up. The same safeguards against misoperation and the same interlocks for safety are provided when using hand control.

This press is one of several sizes available for heading different sizes of cartridge cases. Hydraulic presses are available for this work in capacities of from 600 to 3300 tons. 63

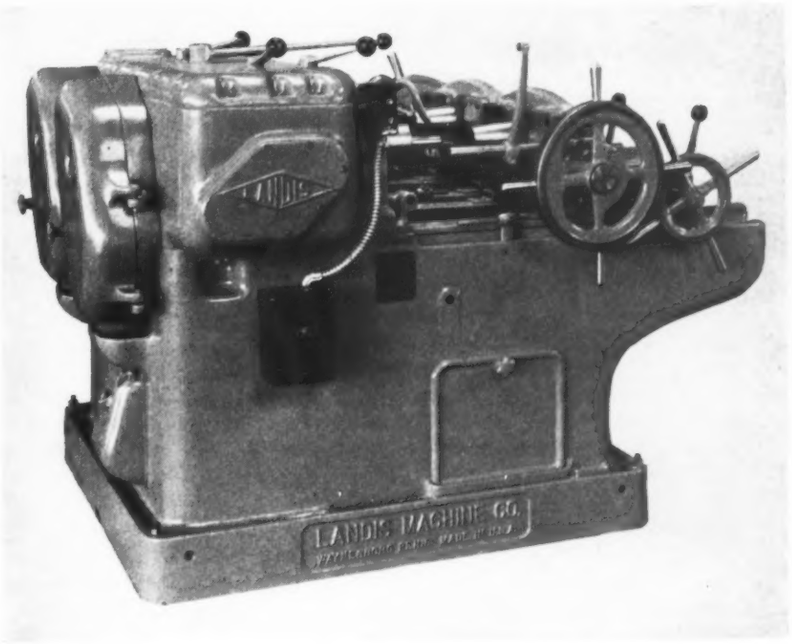
Landmaco Shell Boring Machine

Approved for Publication by the War Department

The Landis Machine Co., Waynesboro, Pa., has brought out a new adaptation of its Landmaco machine for use in removing the excess metal within the bore of the nose end of shells. This operation is, of course, performed after the forming operation and prior to the threading or tapping of the nose end of the shell.

This new machine is equipped to provide an efficient and accurate means of performing this operation on a high-production basis.

The Lanco die-heads, ordinarily supplied with previous machines of this type, have been replaced with a special adapter which supports a boring tool of the replaceable bit type. Special round serrated grips are employed for supporting the work in accurate alignment with the center of rotation of the machine spindle. In addition there is a special work support or cradle immediately in back of the carriage front or vise of the machine which aligns the



Shell Boring Machine Brought out by the Landis Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 166.

work with the work grips and facilitates handling of the shell. A hand-operated stop locates the work in proper relation to the boring tools and assures uniform gripping of all work-pieces. A lead-screw is used to feed the work to the boring tool. 64

"Barnesdril" Vertical Honing Machine

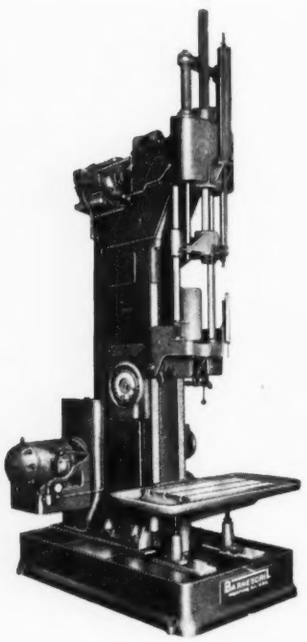
A self-oiling hydraulic honing machine known as the "Barnesdril No. 307" has been designed by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill., for internal honing operations such as generating the final finished surfaces on the interiors of cylinder bores. The machine uses expanding hones provided with several abrasive stones of suitable grit and grade. The honing is accomplished by simultaneous rotation and reciprocation of the hone within the bore, the hone abrasives being under preloaded spring pressure or under hydraulically controlled pressure. Errors resulting from previous processing operations are corrected by this method of honing, and the work is brought to size within extremely close limits. Any desired type of surface finish and any degree of mirror smoothness can be obtained on this machine.

Honing retracting cylinders for airplane landing gears and strut cylinders are operations for which this machine is particularly suited. It can also be adapted for simultaneously honing all four bores of small four-cylinder engine blocks. Oil-well tubing liners can be honed four at a time.

The new machine can be furnished in four different heights with vertical spindle traverse of 25, 30, 35, and 45 inches. These four machines have over-all heights of 144, 159, 174, and 204 inches. All machines will hone work up to a maximum diameter of 6 1/2 inches. The maximum distances from the spindle to the table of the mechanical-tool equipped machines are 62 3/4, 72 3/4, 82 3/4 and 102 3/4 inches. For the hydraulic-tool equipped machines, the maximum distances from the spindle to the table are 56 1/8, 66 1/8, 76 1/8, and 96 1/8 inches.

The machines have a swing of 30 inches, which can be increased to 36 inches on special order. Any number of spindle rotation speeds from 1 to 6 can be provided. The standard spindle speeds of a six-speed machine, with a 1 to 2 ratio, are 77, 105, 141, 200, 270, and 365 R.P.M. The rate of feed for the spindle reciprocations, employing a 1200-R.P.M. driving motor, ranges from 10 to 75 feet per minute. The plain rectangular table is 17 by 30 inches, and has a vertical travel of 17 inches.

These honing machines require a floor space of 76 1/2 by 60 inches, and weigh 7700 pounds in the smallest size. The other sizes weigh 8000, 8500, and 9000 pounds. A 5-H.P. motor operating at 1200 R.P.M. is recommended for the hydraulic system. A 7 1/2-H.P. motor having a speed of 1800 R.P.M. is recommended for spindle rotation in driving hones up to 4 1/2 inches in diameter. A 10-H.P. motor running at 1800 R.P.M. is recommended for spindle rotation in driving hones 4 3/4 to 6 1/2 inches in diameter. 65



"Barnesdril" Self-oiling Vertical Hydraulic Honing Machine

Jefferson Milling Machine and Tilting Dividing Head

A motor-driven "Bull-Dog" high-speed precision milling machine furnished with a floor base, as shown in Fig. 1, or as a bench type with or without power feed, as well as with quick-acting hand-lever feeds, if desired, is being placed on the market by the Jefferson Machine Tool Co., 673-773 W. Fourth St., Cincinnati, Ohio. This machine has been designed for rapid production work. It is especially adapted for such operations as die-sinking, contour profiling, angular milling, jig boring, routing of ferrous and non-ferrous metals, and practically all essential milling operations.

The new milling machine is fitted with Timken roller bearings, and has a collet capacity of 1/2 inch. Table, knee, and traverse feeds are fitted with adjustable dials graduated to 0.001 inch. The table has three 1/2-inch T-slots, a working surface 14 by 4 3/8 inches, and is fitted with a friction feed. A V-belt drive provides four speeds of 200, 400, 700, and 1000 revolutions per minute, power being supplied by a concealed 1/3-H.P. motor. A drum type forward and reverse control is provided for both the bench and floor type machines of this model.

The table has a longitudinal feed of 8 inches and a transverse feed

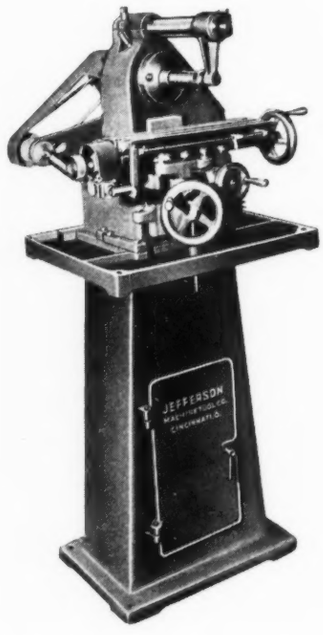


Fig. 1. Jefferson Floor Type Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 166.

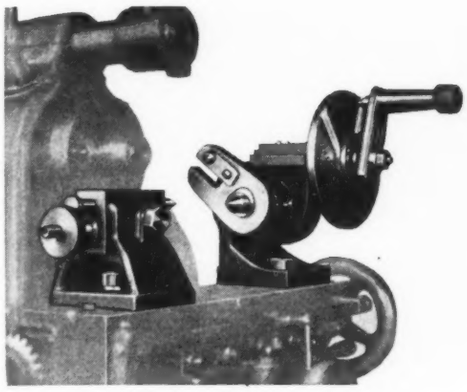
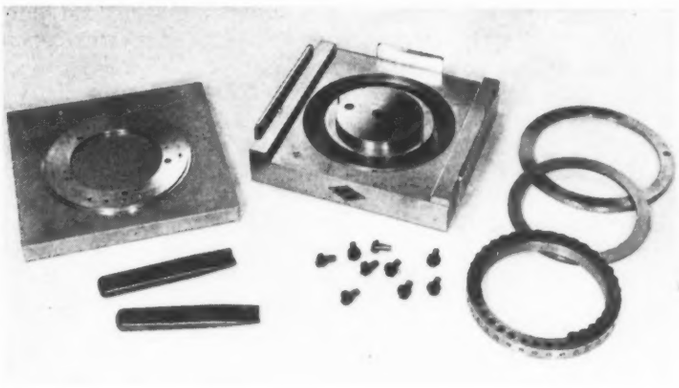


Fig. 2. Jefferson Tilting Dividing Head



View Showing Dial-marking Die Parts, with Marked Dial at Left

of 3 inches. There is a vertical motion to the knee of 5 3/4 inches. The maximum distance from the center of the spindle to the table is 5 3/4 inches. The machine has a height of 52 inches, and weighs 350 pounds in the bench type, and 500 pounds in the floor type.

The 6-inch tilting dividing head shown in Fig. 2 is another new product of the same company. This equipment also includes three indexing plates and tailstock. The tilting dividing head has been designed to provide a well balanced rigid and accurate dividing head. It has a swivel headstock graduated up to 100 degrees. This head can be tilted 5 degrees below the horizontal and 5 degrees past the perpendicular positions.

The worm-wheel ratio is 40 to 1. The spindle is provided with a take-up collar for end thrust. It has a No. 7 B&S taper, and there is a 5/8-inch hole through it. The three indexing plates provide for dividing all numbers up to 50, and even numbers up to 100, with the exception of 96. 66

Force Interchangeable Die for Marking Aircraft Instrument Dials

An interchangeable die for marking aircraft instrument dials which will perform precision numbering jobs on aluminum, locating the markings accurately at the rate of approximately 240 pieces per hour, has been brought out by Wm. A. Force & Co., Inc., 216 Nichols Ave., Brooklyn, N. Y. The die is designed for present-day production, and is of the interchangeable type, with provision for replacing single characters or resetting all characters quickly and easily.

Die-holder rings can be changed, so that the same die can be used to mark different dials or to mark the same dial with different spacings. Pilot-pins position the work radially and concentrically to insure accurate location of the impressions. Bearer bars control the depth of impression, and hardened impression pads provide uniform depth of impression over long periods of use.

The die is easily assembled in a hydraulic press. The aluminum dials are fed by hand and stacked before and after marking, with protective spaces between each piece to avoid scratching or bending. Similar dies are available for marking a wide range of dials. 67

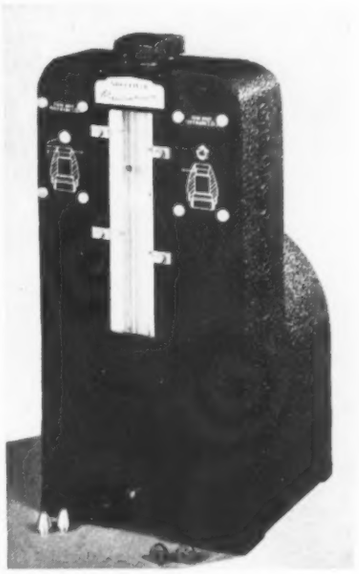
Sheffield Gage for Checking Internal and External Diameters

Approved for Publication by the War Department

The Sheffield Corporation, Dayton, Ohio, has developed a new gage for simultaneously checking external and internal diameters and depths. The gage, known as the "Precisionaire - Electrichek," combines in one housing the features of the "Precisionaire" and "Multichek" gages made by this company. Uniting the functions of both of these gages for one operation increases greatly the speed of inspection and reduces costs.

The "Precisionaire" section measures the rate of flow of air passing through the gaging spindle and the internal diameter. The other section operates on the same principle as the "Multichek" with its independent Reed mechanism gaging unit. Although both sections are independent of each other, they operate simultaneously.

Each of the two indicating tubes with their respective indicating floats has two markers, set at the high and low limits, representing the tolerances of the diameters being checked. The position of the float in the tube indicates whether or not the dimensions of the work are within the required tolerances. If the float stops between the high and low markers, the diameter is within the limits allowed.



Gage for Checking Internal and External Diameters, Made by Sheffield Corporation

To obtain additional information on equipment described on this page, see lower part of page 166.

The light center circle at the upper left-hand corner of the gage shows amber when the diameter being gaged is within the tolerance established by the master; red when the diameter is under size; and green when it is over size.

When the external diameter is within the tolerance specifications, the master "Multichek" signal light between the two indicating tubes is off. Therefore, the inspector need only look at the center of the gage to immediately determine the condition of all diameters being checked. The gaging spindles of both parts of this gage are located at the base, and so placed that the inspector contacts both in one pass.

The "Precisionaire" spindle of the gage shown in the illustration has two orifices, one for each of the internal diameters being checked. Immediately to the left of this spindle is a "Multichek" gage spindle. The Reed mechanism gaging unit of the "Multichek" section protrudes from the rear of the housing. This gage is designed for speed and accuracy, and is claimed to be capable of checking work to fifty-millionths of an inch instantly. 68

Device for Calculating Milling Speeds Quickly and Accurately

To enable the operator of a Cincinnati dial type milling machine to select the correct spindle speed for any combination of work and tool materials and cutter diameter without guesswork or pencil-and-paper calculations, the Cincinnati Milling Machine Co., Cincinnati, Ohio, is now equipping these machines with built-in milling speed calculators like the one shown in the accompanying illustration. The calculator is, in effect, a circular slide-rule especially designed to solve this particular type of problem. No knowledge of mathematics is needed for using it.

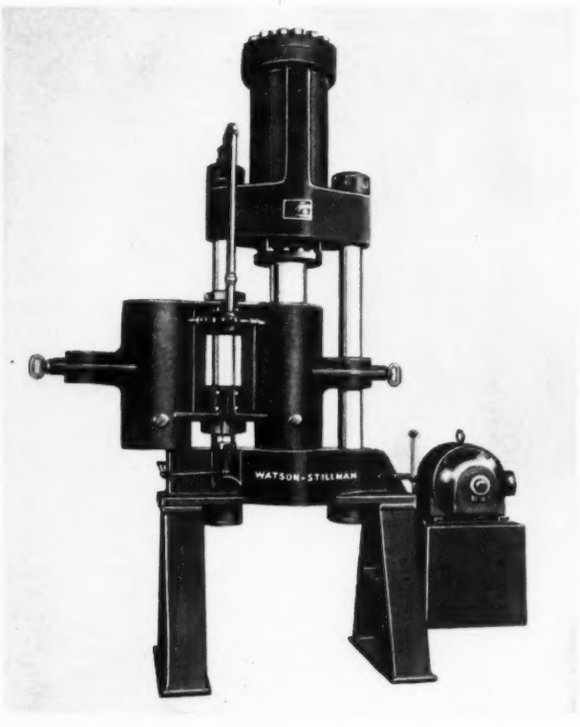
The calculator consists of one stationary disk and two rotatable disks, with a semicircular cover plate in which there are two windows. The operator simply sets the small disk so that the material of the cutter—for instance, high-speed steel—shows in the lower window, and the larger disk so that the arrow in the upper window points to the diameter of the cutter, say, 3 inches. Following the arrow in the section indicating the kind of material being cut—as, for example, S A E X1112—on the smaller disk, the correct cutting speed, in feet per minute, is found to be within the range of 95 to 130, and the spindle speed 142 R.P.M. All the spindle speeds given on the calculator are, of course, available on the dial type milling machine, the total number of speeds on these machines being twenty-one. 69

Hydraulic Filtering or Straining Press

A hydraulic press with a capacity of 200 tons has been brought out by the Watson-Stillman Co., Roselle, N. J., for use in straining or filtering fluids under a pressure of 2000 pounds per square inch. The machine has two cylindrical containers, each 10 inches in diameter and 33 inches deep. These containers are mounted on a swinging arm, so that one can be filled while the press strains the material in the other.

The main press ram has a

Cincinnati Milling Machine Equipped with a Device for Calculating Milling Speeds



Watson-Stillman Filtering or Straining Press Having a Capacity of 200 Tons

To obtain additional information on equipment described on this page, see lower part of page 166.

33-inch stroke and operates in a double-acting cylinder. Two lifting cylinders facilitate swinging the containers between the loading and straining positions. The press is completely self-contained, including a 20-H.P. motor, pump, and oil tank. The entire unit stands 14 feet high, weighs 15,000 pounds, and requires a floor space of 5 by 3 feet. Control is by a single lever-operated valve. 70

Portman Rotary Surface Grinder

A rotary type surface grinder embodying several new features has been placed on the market by the Portman Machine Tool Co., Beechwood Ave. and Carpenter Place, Mount Vernon, N. Y. This grinder is ruggedly constructed, and is provided with ample power to permit fast removal of stock. It is also designed to insure the production of work having a high degree of accuracy and finish. The machine is of the unit type construction, consisting of a heavy box type base containing the entire coolant system, motor-head column, roller-mounted column sub-base, and fixed magnetic rotary chuck drive assembly.

The main drive consists of a totally enclosed 7 1/2-H.P. motor with which the entire precision spindle head is integrally mounted. This spindle-head drive is designed to provide an exceptionally high torque for 8-inch cup type grinding wheels. The spindle assembly is carried on over-sized precision type preloaded bearings. The entire motor head and column assembly is adjustable for grinding concave and convex, as well as flat, surfaces.

The magnetic chuck drive furnishes five speeds for all classes of work, and is driven by a separate motor. The 12-inch magnetic chuck can be used for grinding parts as large as 14 inches in diameter and 9 inches high, when using a new wheel. The motor coolant pump is of the unit type, and supplies a large volume of coolant directly to the work and grinding wheel. The grinder occupies a floor space approximately 3 feet wide by 7 feet deep, and stands 5 feet 9 inches high. Standard equipment includes two cup type grinding wheels, motors, magnetic chuck, demagnetizing switch, motor controls, complete coolant system, splash guards, and wiring. 71

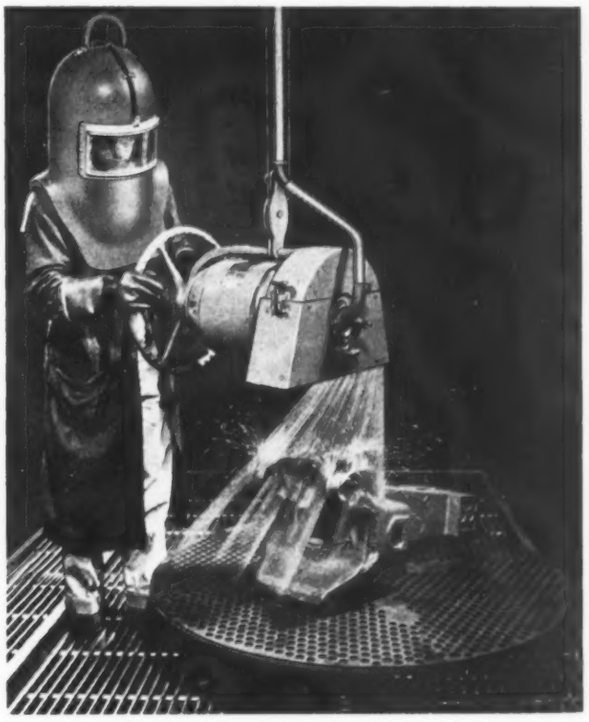
Portable Wheelabrator

A portable Wheelabrator, designed for the airless abrasive blast cleaning of a wide range of work in the blast room, has been added to the line of the American Foundry Equipment Co., 399 S. Byrkit St., Mishawaka, Ind. The flexibility and maneuverability of this equipment in cleaning small miscellaneous products in a blast room without using compressed air were demonstrated recently at the Foundry Show in Cleveland.

This new portable equipment has been successfully applied to the cleaning of intricate, irregular-shaped work, such as that handled in jobbing shops, and other work, the daily production of which does not warrant the use of special equipment. Typical applications include such work as lathe beds, flywheels, gears, pulleys, valves, car wheels, frames, housings, etc.

The unit is suspended by means of a cable which connects with a spring balance that enables it to be easily raised or lowered. The

Rotary Surface Grinder Built by the Portman Machine Tool Co.



Portable Wheelabrator Used for Airless Abrasive Blast Cleaning

To obtain additional information on equipment described on this page, see lower part of page 166.

balance, in turn, is mounted on a carriage that is free to move on a radial track to any point within the blasting area. With this arrangement, the unit can be moved in any direction. The entire unit is mounted in a yoke, the handwheel motor and Wheelabrator unit being integral. By turning the handwheel, the operator can direct the blast at any angle.

Abrasive metallic shot or grit is fed to the wheel through a pipe from an overhead storage hopper. The pipe is arranged with universal couplings to permit free movement of the blasting unit.

The unit is equipped with a 2-H.P., three-phase, 60-cycle, alternating-current motor having a speed of 3600 R.P.M. The over-all dimensions are length, 26 inches; diameter of motor housing, 12 inches; maximum width of Wheelabrator housing, 18 inches; and diameter of handwheel, 17 inches. The unit handles 70 pounds of abrasive per minute at its normal rated capacity. The net weight is about 230 pounds. 72

"Radiac" Abrasive Cut-Off Machine

The "Radiac" Type N abrasive wet cut-off machine recently placed on the market by A. P. de Sanno & Son, Inc., 428 Wheatland St., Phoenixville, Pa., has a patented hand-operated vise, new non-tiring handle, and uses stubs of larger abrasive disks from the larger Radiac or other cut-off machines. It is designed for cutting off bars, tubing, and formed shapes, and is accurately balanced to insure a clean smooth cut that seldom requires any additional finishing.

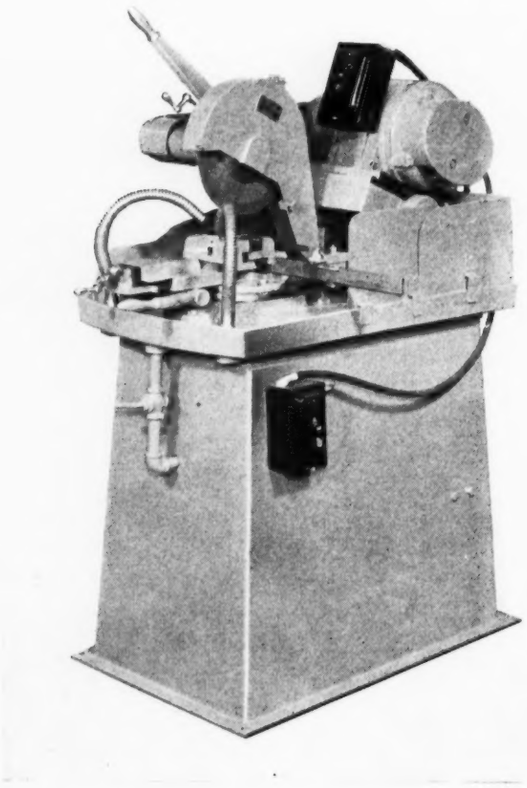
Provision is made for directing a coolant on the wheel and work at the point of cutting to increase wheel life, reduce cutting heat, and minimize any tendency to burn the work. Two types of vises can be supplied, one for straight cuts and one for angular cuts up to 45 degrees. 73

Polishing Abrasive Pads

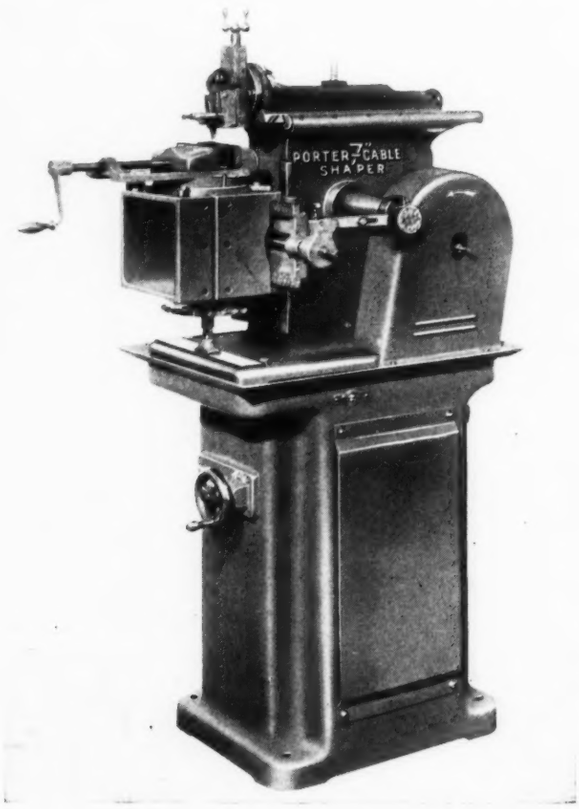
A new product of the Keystone Carbon Co., St. Marys, Pa., is a polishing pad for finishing the surface of cylinder walls. These pads are designed for use in removing all traces of abrasion, sharp edges, and bent-over particles of metal, in order to obtain a finish on the cylinder wall that will eliminate premature wear on pistons and piston-rings. They are finished to fit standard sizes of grinders and hones, and can be made of any size or shape desired. 74

Porter-Cable Shaper

A 7-inch metal shaper is being introduced on the market by the Porter-Cable Machine Co., Syracuse, N. Y. This shaper is a self-contained motor-driven unit with the motor and speed-change control mounted in the floor pedestal. The ram has a travel of 7 3/8 inches, and when driven through the "any speed" control, operates at any desired number of strokes per minute from 64 to 175. The

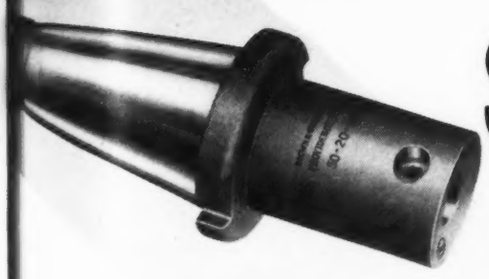


"Radiac" Abrasive Cut-off Machine



Porter-Cable Motor-driven Shaper

To obtain additional information on equipment described on this page, see lower part of page 166.



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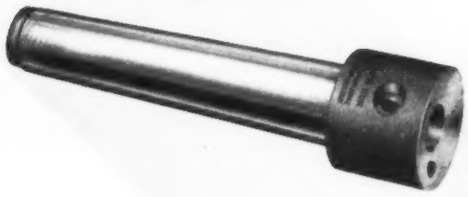

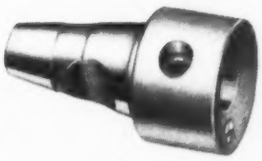

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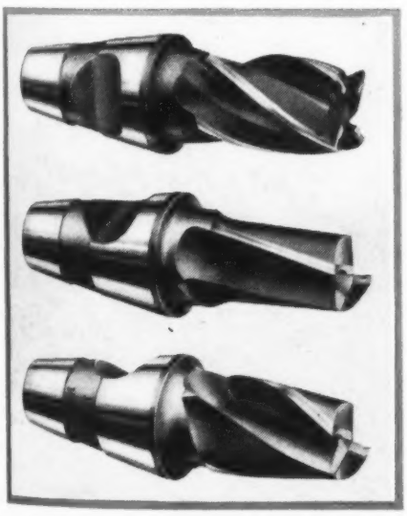

Long-lived end mills with Brown & Sharpe Camlock are included in the wide variety of cutters in the Brown & Sharpe line.

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BROWN & SHARPE CUTTERS

tool-head is 4 inches in diameter, swivels 360 degrees, and travels 2 3/8 inches. The ram is 16 1/8 inches long by 5 inches wide. An 8- by 8- by 7 1/2-inch table has a horizontal traverse of 10 1/2 inches and a vertical travel of 5 1/2 inches. Table adjustment is obtained by means of a handwheel.

A smooth operating sprocket and chain drive and an extra heavy crankpin plate serve to keep chatter down to a minimum. Six cross-feeds are obtainable ranging from 0.002 to 0.012 inch. Tapered pins for quick location of the head and vise, and micro-set ram for quick set-up, are among the outstanding features of this shaper. When equipped with a standard 1/2-H.P. motor and pedestal, the machine weighs approximately 485 pounds and requires a floor space of 14 by 19 inches. The over-all height is approximately 51 inches. 75

Ajax Immersed-Electrode Salt-Bath Furnace

An immersed-electrode salt-bath furnace has been designed by the Ajax Electric Co., Inc., Philadelphia, Pa., for a new operation known as deep-case carburizing, which produces cases up to 1/8 inch, as against 0.050 inch, which was formerly considered the maximum depth of case obtained by immersion methods. These furnaces are equipped with roller type covers to prevent radiation loss between the cycles of immersion and removal of various charges that are to be deeply carburized.

In operation, the furnace utilizes the electromagnetic effect between pairs of closely spaced electrodes, thus heating while simultaneously circulating the cyanide salts. The Ajax furnace employed holds the temperature at approximately 1750 degrees F. within limits of 5 degrees, as required in the new deep-case operation.

The furnaces come equipped with round or rectangular pots, automatic temperature controls, and step-down transformers. The sizes range from 35- to 750-kilowatt rating, with pots from 10 inches in diameter to 20 feet in length for deep-case carburizing of large plate sections and shafts. 76

Stow Flexible-Shaft Units with Heavy-Duty Angle Drills

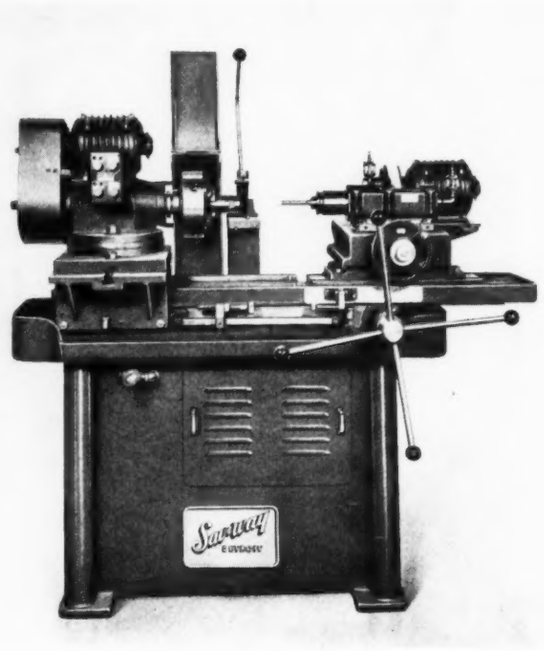
For drilling in hard-to-reach spots, the Stow Mfg. Co., Inc., 15 Shear St., Binghamton, N. Y., has brought out flexible-shaft units with 45- and 90-degree angle-heads, designed as shown in the accompanying illustration. These units can be easily hooked up by simply fitting the end of the shaft into an electric drill chuck. The standard shaft length is 30 inches.

Both the 45- and 90-degree angle drill heads are built for heavy-duty service, being gear-driven, of the full ball-bearing type, and permanently attached to the flexible shaft. The spindle heads are threaded for adapters, 1/4-28 thread, accommodating either stub or full-length drills up to the No. 30 size. The clearance distance from the drill center to the outer surface of the angle-head housing is 3/8 inch. 77

Stow Flexible-shaft Units with 45- and 90-degree Angle Drilling Heads

Sav-Way Internal Grinder

An internal precision grinder with a capacity for grinding holes up to 9 inches deep and from 1/4 to 18 inches in diameter, with either straight or tapered sides, has been placed on the market by the Sav-Way Tool & Machining Co., 13844 Jos. Campau Ave., Detroit, Mich. This machine has been designed for greater flexibility and to permit handling a wider range of work than was possible on any previous machine. It is suitable for tool-room or production grinding.



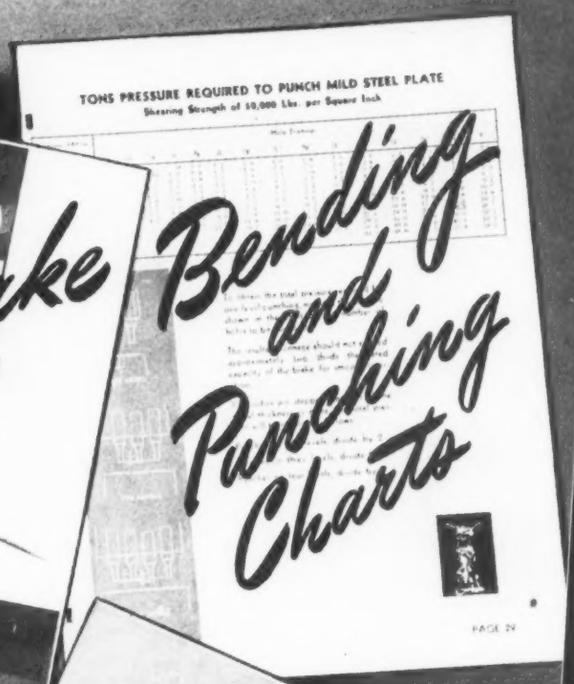
Precision Internal Grinder Built by the Sav-Way Tool & Machining Co.

The headstock is so constructed that loosening two nuts permits an adjustment to a distance of 3 1/2 inches at right angles to the direction of the wheel traverse. This enables angles to be ground that could not previously be reached by rotation of the headstock or traverse of the wheel. Variable V-belt pulleys provide four speeds for the workhead.

The grinding wheelhead can be adjusted to 0.0001 inch. The diamond-holder is of the swing type with microm-

To obtain additional information on equipment described on this page, see lower part of page 166.

NEW CATALOG



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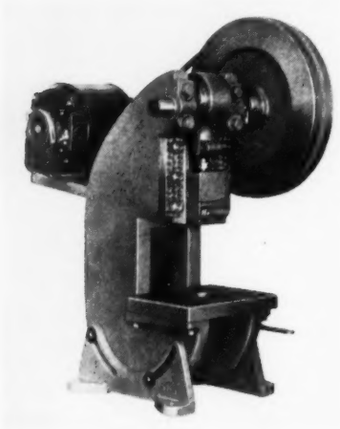
eter adjustment, which enables the operator to set the diamonds accurately for sizing holes. The machine is equipped with automatic wheel guard, motors, coolant pump, and electric controls. It weighs 3130 pounds, and the base measures 40 by 22 inches. 78



Duro Punch Press Made in One- and Four-ton Sizes

Duro Punch Presses

A new punch press built by the Duro Mfg. Co., 800 E. 61st St., Los Angeles, Calif., is available in 1- and 4-ton models. According to the manufacturer, these presses have many features not found in any but the heaviest presses. One of these is the heat-treated alloy steel driving shaft, which is straight and the same size throughout. This shaft has been designed especially to eliminate the danger of shearing or twisting.

Directional change of the punch force is obtained by a unique eccentric, which is a press fit on the driving shaft, where it is held securely by keys. The eccentric operates in heavy bronze bearings designed to insure long life at high production speeds. The ram or punch slides in semi-steel guides, which are slotted for lubricant distribution and adjustable for wear.

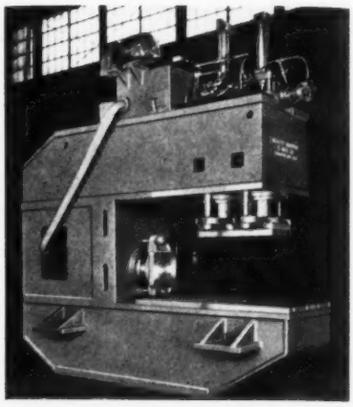
The 1-ton press has a stroke of 3/4 inch, and is 8 inches wide, 17 inches high, and 10 inches deep. It weighs 60 pounds, and accommodates dies up to 3 3/4 inches. The 4-ton press has a stroke of 1 inch, and is 12 inches wide, 25 inches high, and 15 inches deep. It weighs 185 pounds, and accommodates dies up to 4 3/4 inches. 79

Beatty Hydraulic Forming and Flanging Press

A hydraulic forming and flanging press which is available in capacities up to 400 tons and has a new self-cooling hydraulic oil system that eliminates the need for cooling coils has been developed by the Beatty Machine & Mfg. Co., Hammond, Ind. The new type oil circuit eliminates the difficulties experienced with hot oil and the danger that a water-line may freeze or crack and allow water to enter the oil supply tank.

The hydraulic oil circuit is so arranged that the two vertical cylinders, each having a capacity of 200 tons, can be tied together and operated as a single 400-ton unit under the control of one lever. When used for flanging, the front cylinder advances to the work on the down stroke at the rate of 290 inches per minute, and holds the work under pressure while the horizontal ram advances at the same rate. Under a full load, this ram advances at the rate of 21 inches per minute. All cylinders are controlled by a manual valve lever.

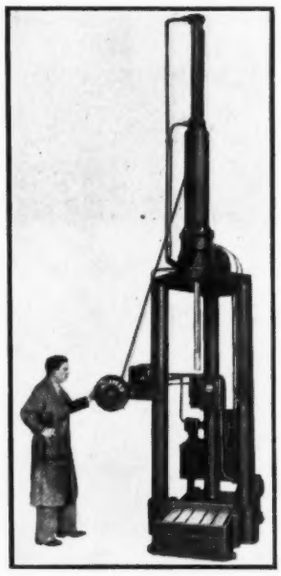
The maximum daylight space of the press is 45 inches, the stroke of the cylinders 24 inches, and the depth of throat 66 inches from the center of the vertical cylinders to the housing. The lower platen is 48 inches wide right to left and 88 inches deep front to back. These dimensions naturally vary with the size of the machine, and can be changed to adapt the machine for the particular work to be handled. 80



Beatty Hydraulic Forming and Flanging Press with Improved Oil Circuit

High-Speed Honing and Lapping Machine

Internal cylindrical surfaces of bores up to 24 inches in diameter and of any length from 20 up to 72 inches can be honed on the new "Hi-Speed" honing and lapping machine manufactured by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill. This machine is designed to permit rapid, accurate, and economical honing of a wide range of work, being especially adapted for straight-line lapping or co-directional honing. It can be used to remove high spots, out-of-roundness, and taper, and to produce round and straight bores having finely finished surfaces.



"Hi-Speed" Honing Machine

The stroke or height under the spindle nose can be varied to suit almost any type of honing work. Any stroke setting, withdrawal of the hone from the cylinder, short stroking at any point, and changes of speed of reciprocation or rotation of the spindle can be accomplished from the front of the machine. A positive stop and dwell system makes possible the stopping of the spindle at the bottom of each stroke or at any point in the stroke range without shock to the machine or work. The spindle can be held at any point desired up to 1 1/2 minutes. This feature makes the machine especially useful in honing blind holes. 81

To obtain additional information on equipment described on this page, see lower part of page 166.

MINE MAINTENANCE

with a Super Service Radial

Today in many large plants the Maintenance Shop is one of the most important and vital departments. Nothing less than the most dependable, most versatile tools can be tolerated in such shops.

The above photograph shows one of the three Super Service Radial Drills in the UNDERGROUND MAINTENANCE SHOP of a large mine where they are relied upon for a variety of metal drilling operations.

These machines have a wide range of speeds and feeds, long-lived accuracy and features for fast, easy operation. The distinctive features of the Super Service Radial Drills are explained in Bulletin R-24. Write for it today.

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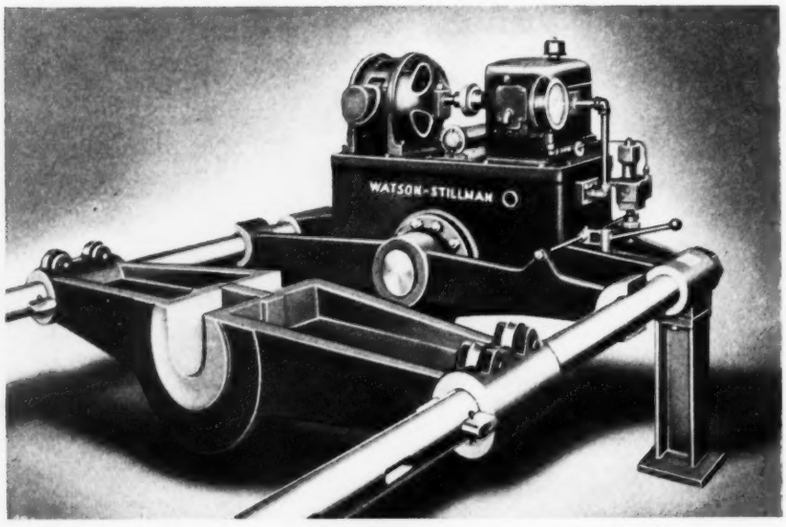


Self-contained 100-ton Forcing Press Built by Watson-Stillman Co.

Watson-Stillman Forcing Press

A new 100-ton forcing press has been built by the Watson-Stillman Co., Roselle, N. J. This press represents an improvement over former types in that control of all motions is accomplished by a single hand-lever. The unit is entirely self-contained, including the 10-H.P. motor and variable-delivery radial piston pump.

The press is of the horizontal two-bar type. It is equipped for forcing shafts into rotors, but is also suitable for many other forcing operations. The distance between bars is 72 inches, the opening is adjustable from 24 to 120 inches, and the stroke of the ram is 18 inches. The gap in the rear abutment will accommodate shafts up to 6 inches in diameter.

The advance speed of the ram is at the rate of 200 inches per minute, the pressing speed is variable from 0 to 25 inches per minute, and the return speed is at the rate of 140 inches per minute. The entire unit weighs 10,000 pounds. 82

Hand-Operated Straightening Press

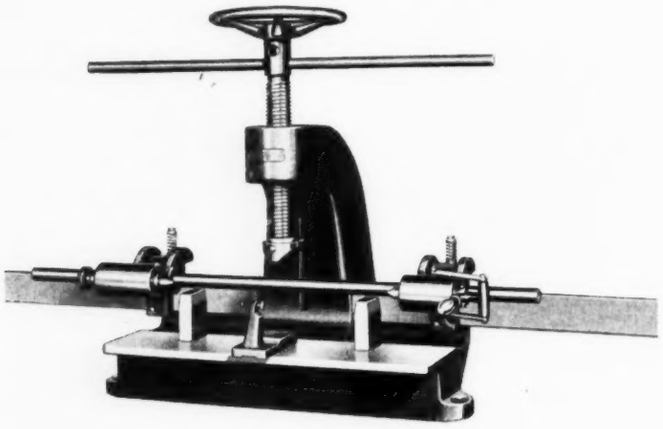
A powerful hand-operated straightening press of simple rugged design known as No. 5, is built by the General Mfg. Co., Detroit, Mich., for use in heat-treating shops, tool-rooms, or wherever straightening is to be done on a wide variety of parts.

The press shown in the accompanying illustration is equipped with a No. 76 lock-lever, center type, shaft-straightening attachment. The opening capacity is 12 inches, the stroke 9 inches, the throat depth 5 inches, the table length 30 inches, and the table width 8 inches. The diameter of the 3-pitch Acme screw thread is 2 3/8 inches. The straightening attachment track has a length of 85 inches, and the maximum standard distance between the centers or rollers is 36 inches. The weight of the press alone is 470 pounds, and with the attachment, 610 pounds. 83

Dodge Wood Sheave for V-Belt Drive

The "Victory" wood sheave for V-belt drives is now being offered to the trade as an alternate for metal sheaves by the Dodge Mfg. Corporation, Mishawaka, Ind. The efficiency of this sheave is said to equal in every way that of metal sheaves, except where the flywheel effect is essential. It is of laminated construction, with the segments made of selected straight-grained kiln-dried hard maple. Wood bushings are used, provision being made for firm fastening to the shaft.

These sheaves are made in composite groove types for "A" and "B" section belts in a full range of sizes; for "B" belts in a wide range of sizes up to ten grooves; and for "C" belts in a wide range of sizes up to twelve grooves. 84



Hand-operated Screw Type Straightening Press Built by General Mfg. Co.

"Victory" Wood Sheaves for V-belt Drives, Made by Dodge Mfg. Corporation

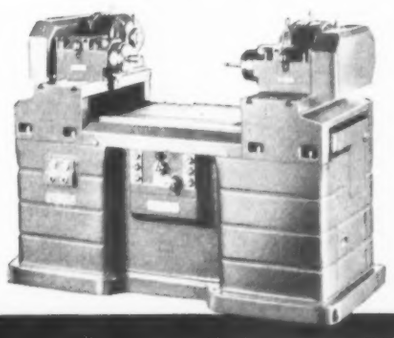
To obtain additional information on equipment described on this page, see lower part of page 166.

WINNING THIS WAR IS EVERYBODY'S JOB

Thousands of new workers are pouring into factory doors to help produce the billions of dollars' worth of material vitally and immediately needed to win this war . . . sufficient long-experienced operators are just not available . . . it's a time when a modern type of standard machine tool like the Ex-Cell-O Precision Boring Machine can meet the emergency by doing a dual job: its easy control and automatic operating features make it possible to train ordinary operators in an exceptionally brief time to bore, turn, face, groove metal parts to the highest commercial standards of precision in size and finish, with a minimum of operator fatigue; this ease of operation, combined with basically sound engineering design and substantial, rigid construction for which all Ex-Cell-O machine tools are noted, *assures the extreme in production, every hour, every day.*

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

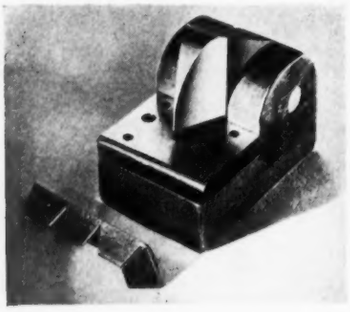
Below: Standard Double-End Ex-Cell-O *Precision* Boring Machine—used for many multiple and progressive operations, on the same part or various parts, to speed up war production.



XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, ★ TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS



Wales Die Made in Complete Range of Notching Angle Sizes

Wales Notching Die

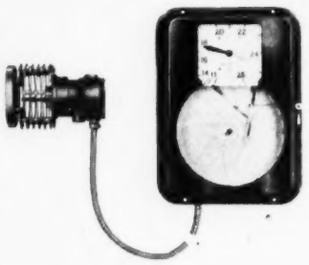
A new line of Wales notching dies has been placed on the market by the Strippit Corporation, 1200 Niagara St., Buffalo, N. Y. These dies are designed to notch 11-gage angle-iron for the full width or depth of one leg or side, and are available in a complete range of notching angle sizes. When used for notching angle-iron that is to be bent, the dies are arranged to leave a portion of the metal untouched in the corner of the angle to permit easy bending into position for welding the legs.

These dies are self-contained, the punch and die being kept in constant alignment, with no part of the die attached to the ram of the press. Any desired number of dies can be used on a T-slotted plate to perform a complete multiple notching operation in one stroke of the press. Pattern set-up changes with these notching dies can be made in a few minutes. The dies can be set up by positioning the holders with a templet, after which they are locked in place. 85

Radiation Pyrometer

A new radiation pyrometer known as the "Pyrovac" has been developed by the Bristol Co., Waterbury, Conn., for recording, indicating, or automatically controlling temperatures in furnaces above 900 degrees F. The temperature-sensitive unit is mounted on the outside of the furnace, out of the hot zone where it picks up heat rays emitted from the object, thus registering its surface temperature.

This instrument is adapted for use in measuring and automatically



Bristol Radiation Pyrometer

controlling temperatures above the normal range of the thermo-couple; temperatures for which rare-metal thermo-couples are ordinarily used; surface temperatures of retorts; the temperature of the work itself rather than the furnace temperature surrounding the work; and temperatures of objects that are moving, inaccessible, or in a space of restricted area. 87

Scherr Tool Stand for Holding Gages

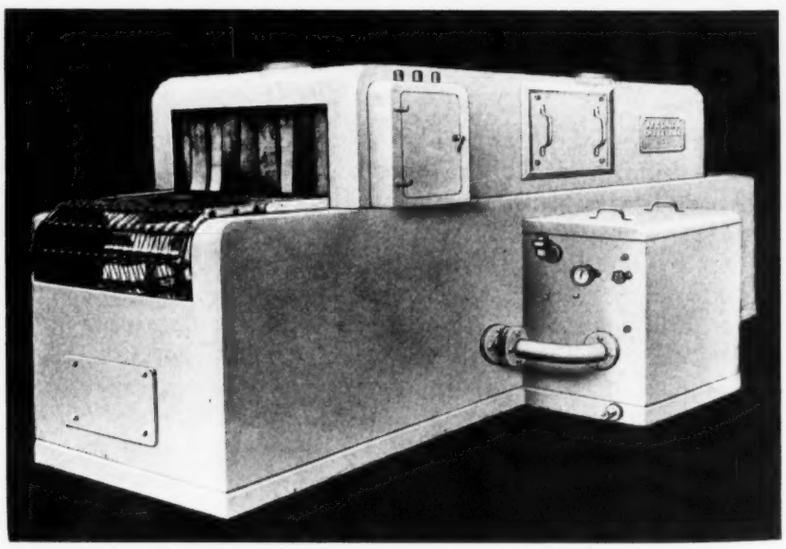
Scherr Tool Stand

A new product of the George Scherr Co., 128 Lafayette St., New York City, is a stand designed primarily to serve as a vise or clamp for holding micrometers, snap gages, etc., thus eliminating distortion of these tools by heat transmitted to them from the hand. It is stated that a gage can be distorted by the heat from the hand sufficiently to make accurate reliable measurements impossible, a difference in temperature of only 10 to 15 degrees expanding a 2-inch micrometer approximately 0.0005 inch, as well as throwing the measuring anvils out of parallelism.

The Scherr tool stand shown in the illustration is so constructed that the micrometer or snap gage can be held securely without damage to the finish of the frame and without heat from the hand affecting its accuracy. The jaws are parallel and without serrations. A

Magnus Metal Washing Machine

A line of mechanical metal washing machines, pickling machines, dryers, ovens, and burnishing equipment is being placed on the market by the Machine Division of the Magnus Chemical Co., Inc., Garwood, N. J. Considerable attention is being given by this company to the development and manufacture of machines for use in connection with the Magnus Emulso - Dip and Emulso - Spray processes. These processes represent special methods developed to permit metal parts to be cleaned more effectively at lower cost. 86



Metal Washing Machine Made by Magnus Chemical Co., Inc.

To obtain additional information on equipment described on this page, see lower part of page 166.

An application which emphasizes the extreme flexibility of the Milwaukee Duplex Milling Machine.

KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

Every cut counts on the production line . . . in bringing Victory on the firing line.

KEARNEY & TRECKER CORP., MILWAUKEE, WIS., U. S. A.

Milwaukee MILLING MACHINES

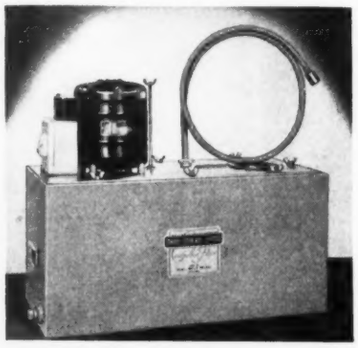
small piece of Scotch tape placed on the inside will serve to hold the tool firmly without requiring too much clamping pressure. The jaws can be swiveled from the vertical to the horizontal position. The base is cast iron, and the jaws are made of cold-rolled steel. 88

Gray Portable Coolant Pumps for Machine Tool Service

Three new portable coolant pumps designed for the automatic application of coolants to cutting tools are being introduced on the market by the Gray-Mills Co., 213 W. Ontario St., Chicago, Ill. These new models, designated the Gray heavy-duty "A" series pumps, G-2A, G-3A, and G-4A, like the original "G" series, have been developed to prolong tool life, increase production, and lower operating costs. They are especially adapted for use in heavy-duty machine tool service.

Features of the new series pumps include complete portability; control of the coolant flow from a few drops to a full stream; baffle-plate construction and forced settling fixture for keeping coolant fluids clean. The latter feature is especially advantageous for abrasive grinding, milling, and honing machines. Other features include large tank capacities of 10 and 12 1/2 gallons, which eliminate frequent coolant changes; ball-bearing type motors; easily replaced driving gears that are hardened to insure long wear; clean-out plug for easy and quick tank cleaning; flexible power shaft coupling; and easy access to all working parts. On machine set-ups requiring the application of coolant at four to six points a separate flow regulator is provided for each delivery point.

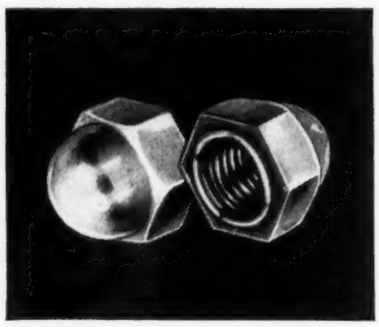
Standard machine working tables can be adapted to coolant pump use with especially designed "Flo-Bac" pans. "Flo-Bac" fittings permit permanent and easy attachment to single- and multiple-spindle drill presses. 89



Gray Heavy-duty Portable Coolant Pump

"An-Cor-Lox" Lock-Nut of Cap-Nut Shape

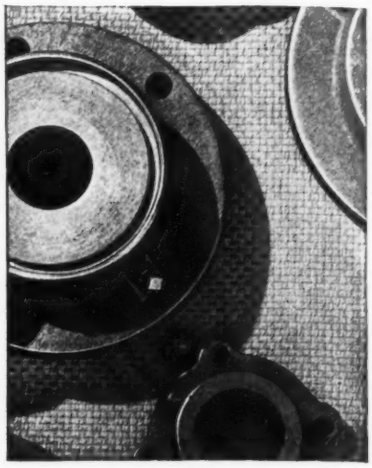
"An-cor-lox" lock-nuts made by the An-cor-lox Division of the Laminated Shim Co., Inc., 75 Union St., Glenbrook, Conn., are now available in cap or acorn shapes. The cap-nuts can be made to suit the user's specifications. A wide choice of materials for the nut body is available, and the locking-ring insert can also be obtained in a variety of metallic compositions. All standard sizes, measured by bolt diameter dimensions, are available and can be obtained with thick or thin walls. These cap-nuts are of all-metal construction and self-contained, the locking ring being made integral with the body of the nut itself. 90



"An-cor-lox" Lock-nuts

Standardized Covers for Ball and Roller Bearings

A dust- and grease-tight closure for bearing housings in a complete range of types and sizes has recently been developed by the R-S Products Corporation, 4530 Germantown Ave., Philadelphia, Pa. Low unit cost in small or large quantities; reduction in designing, drafting, and checking time; as well as the elimination of costs for patterns, fixtures, and gages are advantages claimed for these covers. 91



Ball and Roller Bearing Covers Developed by the R-S Products Corporation

"Airgrip" Chuck for Thin-Walled Flasks

Forged-steel flasks, 21 inches in diameter, with walls only 3/8 inch thick, can be machined to a tolerance of 0.010 inch on the outside diameter through the use of special "Airgrip" chucks, made by the Anker-Holth Mfg. Co., Chicago, Ill. Each "Airgrip" chuck weighs 464 pounds. The 24-inch locater is mounted on a 15-inch, three-jaw universal chuck, as shown in the accompanying illustration. The jaws have a stroke of 1 inch and an expansion of 1 inch in the flask. Twelve pads are provided to prevent distortion of the flask wall. The matched false jaws are balanced to within 1/4 ounce. 92

"Airgrip" Chuck for Large Thin-walled Flasks

To obtain additional information on equipment described on this page, see lower part of page 166.

NEW HORIZONS

FORWARD-LOOKING manufacturers, because of thorough research and experience in their particular fields, can aid in establishing a better social and economic order in more ways than by providing machinery and merchandise. That is why Continental Machines, Inc. deal out fresh ideas and usable information every little while.

MACHINES CREATE EMPLOYMENT

During the gray days of the past decade, many people believed that machines were one of the chief causes of unemployment. In 1939 Continental published "Machines and Progress", a panoramic wall chart 5 feet long and 2 feet high, matching mechanical development through the years with employment figures. This study shows that machines are in reality the stepladders to higher standards of living. There are still a few of these charts on hand, if you'd like to have one.

STIMULATING YOUNG MEN'S INTEREST

Before there was too great a scarcity of mechanics and tool makers, Continental made a bold bid to young men everywhere to swap their frayed white collars for honest, money-making overalls. They published "12 Easy Lessons In Machine Shop Practice". This illustrated study course was distributed to schools, Y.M.C.A.'s, Boys Clubs, and hung in factories from coast to coast. It became so popular that it had to be reprinted this year. Would you like a copy?

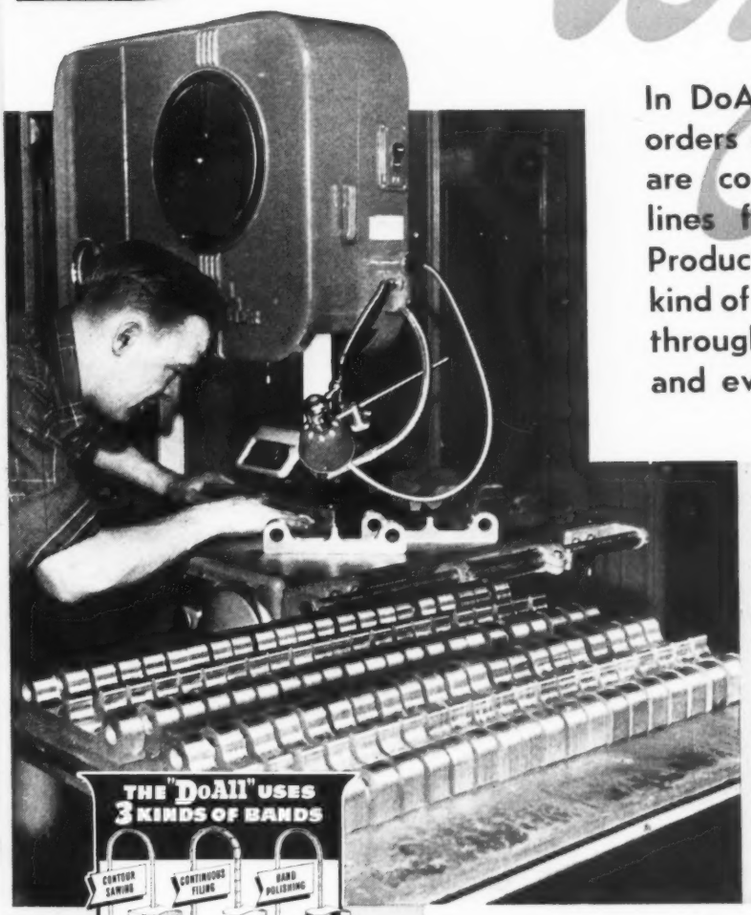
FREE TRAINING COURSES

The DoAll Trade School, Minneapolis, gives *Free* training in the use of DoAll Contour Machines, Surface Grinders, Lathes, Shapers, Milling Machines, etc. Into a short course are packed 200 to 500 hours of actual shop work, lectures, movies, experiments with new metals, etc. Sixty students are graduated and placed in industry every month. If you know a young man who wants to learn how to do a multitude of jobs faster and better, send for application blank. Or, it may be that you can use one of the School's graduates in your plant.

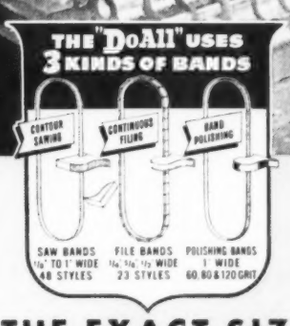
CUTTING COSTS

A brand new book of few words and loads of illustrations, prepared in a snappy, Chalk Talk style that won't let you put it down until you reach Page 48 and the last one of the "40 Ways To Cut Machining Costs." Let us send you a copy.

DoAll Wizard PRODUCTION



In DoAll equipped plants, war orders on direct or sub contract are coming off the assembly lines far ahead of schedules. Products or parts made from any kind of metal or alloy are shoved through to completion in ½, ¼ and even ⅛ former time.

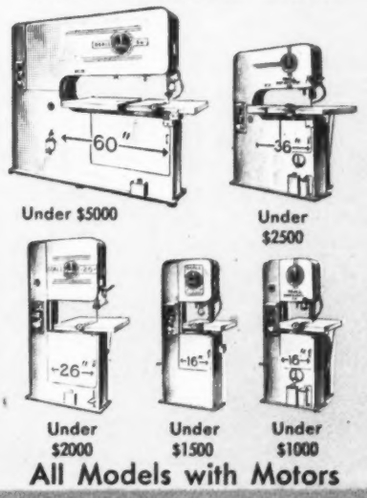

THE "DoALL" USES 3 KINDS OF BANDS
CONTOUR SAWING
CONTINUOUS FILING
BAND POLISHING
SAW BANDS ⅛" TO 1" WIDE 48 STYLES
FILE BANDS ⅛" TO 3" WIDE 23 STYLES
POLISHING BANDS 1" WIDE 60, 80 & 120 GRIT

Left— Production work on Swedish steel 1" thick. A much improved and faster method over shaping or milling.

Right— Internal finishing of large brass collector rings.

Steel alloy aircraft tubing cutoff production for airplane motor mounting frame work. New war-time job for this firm.

THE EXACT SIZE FOR YOUR JOB



All Models with Motors

DO ALL AIM

To shorten the war and get back to peace-time work on everything American from automobiles to lawn sprinklers.

DoAlls offer the fastest precision method to remove metal. They relieve $5,000 to $50,000 machine tools of over-load work and have become absolute **musts** in every modern plant.

BETTER INVESTIGATE

Let us send a factory-trained production man to your plant with a DoAll to show you how it can short-cut your orders to completion.

NEW BOOK—"DoAll on Production"—50 pictures of DoAlls at work all over the country. Prepared for quick reading by busy men. Send for copy.

CONTINENTAL MACHINES, INC.

1312 S. Washington Ave., Minneapolis, Minn.

Associated with the DoAll Company, Des Plaines, Ill., Manufacturers of Band Saws and Band Files for DoAll Contour Machines.

Cleaning Aluminum and Magnesium

The preparation of aluminum and magnesium for various fabricating operations is a common problem in many plants today. Because aluminum and magnesium are sensitive metals which, unless care is exercised, become pitted, etched, or discolored when cleaned with harsh alkaline solutions before and after heat-treatment, the application of proper methods is of great importance. The following information is based upon data obtained from Oakite Products, Inc., New York City. The procedure outlined is now being successfully used to speed up production in aircraft and accessory plants.

Cleaning before Heat-Treating

The removal of oil, dirt, and grease from aluminum and magnesium parts before heat-treating is done by immersing the parts in a tank containing a solution of Oakite Aviation Cleaner, using 4 ounces of the cleaner to each gallon of water. The temperature of the solution is maintained at a point of from 170 to 212 degrees F., depending on the conditions. The time of immersion is usually five minutes, but may vary somewhat according to the amount of matter to be cleaned off. The cleaning process is completed by a thorough rinse in running water.

Cleaning after Heat-Treating

Heat stains or discoloration appearing on aluminum sheets or parts as a result of heat-treatment and quenching may be removed and the original finish of the parts restored by immersing the work from two to fifteen minutes in a solution of Oakite Compound No. 84-A, using 8 ounces of the compound to each gallon of water and maintaining the solution at a temperature of 180 degrees F. In those cases where oil and grease are present, as well as a heat-treating film, the work is precleaned by the tank method described in the previous paragraph prior to immersion in the solution of Compound No. 84-A.

The material and method used for removing heat stains and discoloration are also suitable for use in connection with such operations as (1) degreasing aluminum parts before anodizing; (2) preparing aluminum alloy structures, assemblies, and parts for resistance spot-welding; (3) removing anodizing film from rejected aluminum parts; and (4) stripping anodizing coatings from racks, straps, hooks, etc. The concentration and temperature of the solution and the time of immersion are determined by the particular types of work to be done and the condition of the parts to be cleaned or stripped.

American Society for Testing Materials to Meet in Atlantic City

The forty-fifth annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 22 to 26. Eighteen technical sessions are scheduled to be held at this meeting, in addition to more than one hundred and fifty committee meetings. Approximately one hundred technical papers and reports will be presented before the Society at that time, covering almost every phase of the work in the material testing field. Further information can be obtained by addressing the secretary of the Society, 260 S. Broad St., Philadelphia, Pa.

Shortage in Chlorinated Solvents Requires New Cleaning Methods

Fabricators of metals have been advised by the Chemicals Branch of the War Production Board to investigate every possible metal cleaning method other than by the use of chlorinated solvents. There is a shortage of these solvents, and the situation will become more difficult with the vast increase in metal fabrication. At least 30 per cent of the cleaning operations in the metals industry now being done with chlorinated solvents, it is stated, could be accomplished by the use of other materials, such as mineral spirits, non-chlorinated solvent-water emulsions, and alkalies.

Salvaging Scrap Metal

Enough metal—350,000 pounds to be exact—to build more than nine 18-ton army tanks, has been collected in an intensive scrap campaign at the East Springfield, Mass., plant of the Westinghouse Electric & Mfg. Co. This campaign was carried on to bring forth from work benches, tool chests, and factory floors all excess materials not necessary for war production. Old dies, tools, and fixtures that would have no further use in the war program were also thrown into the scrap pile. The scrap collected by the employes was deposited in large containers located at all factory gates. The proceeds from the sale of the employe contributions were turned over to the Red Cross.

* * *

"Upgrading" Will Help Solve Employment Problems

Rapid "upgrading" of plant personnel to solve one of the difficulties in the present employment situation was advocated by P. L. Dildine, manager of factory standards of the B. F. Goodrich Co., Akron, Ohio, before a recent meeting of the American Management Association. He advocated giving men from the rank and file a chance to fill responsible positions whenever they indicated abilities in that direction. "All things considered," he said, "the most dependable place to seek men to fill responsible factory positions in these times is within one's own organization."

* * *

Preparing for Post-War Conditions

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has established a special reserve fund in which is set aside an amount equal to 1/2 per cent of the payroll each month. This fund will be used for unemployment benefits to employes who may be laid off during the change-over from emergency war production to normal conditions. This fund is additional to the federal and state unemployment insurance funds to which Westinghouse contributed over $4,000,000 in 1941.

ZINC IN WAR

PROTECTING THE MERCHANT MARINE

The United States must not only out-produce our enemies, we must see to it that this matériel reaches the far flung fighting fronts. To this end America has dedicated itself to the most gigantic ship building program in all history—and these vessels must be made as efficient as humanly possible for the courageous men who sail them.

Zinc plays an important role in protecting metal surfaces, and thus protecting men at sea. Working metal parts on ships can easily be fouled by rust. To insure efficient operation when emergencies demand quick action, such important parts as life-boat davits, shown above, are sprayed with protective zinc coatings. The corrosion-inhibiting properties of galvanized (zinc coated) iron or steel are well known —and sprayed zinc dust provides this same measure of protection for metal surfaces which do not lend themselves to galvanizing.

The photographs in the background of this advertisement show: (1)—left to right—Cast iron sheaves for life-boat davits before finishing, after grit blasting and after spraying. (2) Stacks of completely finished sheaves. (3) Grit blasting the sheaves and (4) Spraying them with zinc dust using a special gun.

Other important uses for sprayed zinc include marine floats, airplane pontoons and canal gates. The needs of the Navy and Merchant Marine for sprayed zinc coatings are just additional reasons why civilian users of zinc may not be able to obtain all of the metal or pigment they would like to use.

THE NEW JERSEY ZINC COMPANY

MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS

1 METAL SPRAYING
2 GALVANIZING
3 NICKEL SILVER
4 HULL PLATES
5 RUBBER
6 PAINT
7 BRASS
8 CERAMICS
9 DIE CASTING
10 PHARMACEUTICALS

Stanley P. Gould, Who Has Read MACHINERY for Forty-Six Years, Tells the Reason Why

When a man has read a technical magazine continuously for forty-six years, it qualifies as news. Stanley P. Gould, of Los Angeles, Calif., has read MACHINERY since 1896, and has been a regular subscriber since 1898. Recently, he wrote: "As an apprentice I learned more by reading MACHINERY, including the advertisements, than I did by practice in the shop. MACHINERY informed me of all the latest tools and methods, and of how the other fellow did it. MACHINERY'S HANDBOOK and your numerous other publications are compiled to a great extent from information obtained directly from the mechanic in the shop. They are written so that any mechanic who will devote a little time to them can acquire considerable knowledge even though he lacks an engineering education. Since MACHINERY is a monthly publication, one has ample time to read one number before the arrival of the next. A single idea is often worth the price of a year's subscription, and your journal is a good investment for any apprentice or mechanic."

Stanley P. Gould, Who has Read "Machinery" Continuously Ever Since He was an Apprentice

Mr. Gould was born in Grand Rapids, Mich., in 1878, and went to California in 1887. He started as a machinist apprentice in 1896, and has worked in and around Los Angeles ever since, as a machinist, foreman, estimator, salesman, and shop proprietor. His specialty is special machine and job shop work on which, in the past, he has contributed several articles to MACHINERY. He is now with the Department of Water and Power of the City of Los Angeles.

Salt Necessary for Workers During Hot Months

Until recently, one of the most baffling and serious causes of disability, particularly prevalent among workers engaged in hot, heavy work, has been heat sickness or heat cramps. In its milder forms, heat sickness often is not recognized as such, since it simply causes loss of energy, increased fatigue, and a let-down in productive effort.

Research has shown that loss of salt from the body through excessive perspiration is at the bottom of the trouble. When the salt loss is slight, the first reaction is a tired, uncomfortable feeling. If this condition is allowed to continue without any effort to remedy it, actual heat sickness and muscle cramps may result. Even a slight salt loss saps energy and slows up muscular coordination.

The remedy, however, is simple. If the salt loss is made up, the body is restored to a normal condition. The average person obtains his necessary daily quota from the salt used in his food, but workers engaged in heavy work or long hours in hot surroundings must have extra salt to compensate for loss through perspiration.

It is generally agreed among industrial physicians that the average worker needs, during the day, one level teaspoonful of salt for each gallon of water that he drinks. Various methods are employed to supply this salt to the workers. Some plants add the proper percentage of salt to the drinking water. This method, while entirely satisfactory, involves the installation of equipment.

The use of salt tablets and tablet-dispensing machines placed near drinking fountains or on portable water coolers has become increasingly popular. The tablets contain regular table salt compressed under pressure to a 10-grain size—approximately the size of an aspirin tablet. They are swallowed whole with a drink of water. No salt taste is noticeable and the tablets dissolve within thirty seconds after being swallowed.

Educational posters placed on bulletin boards and near drinking fountains are used to point out to the workers the importance of replacing salt lost through perspiration and to encourage them to take the salt tablets throughout the day whenever they take a drink of water. Workers engaged in light and medium work require from four to six tablets a day; those in heavier work, from eight to ten tablets; and workers on unusually heavy, hot work, from twelve to fifteen tablets in an eight-hour day.

* * *

General Electric Makes Awards to Employes

The Charles A. Coffin Foundation Awards were recently made to thirty-seven employes of the General Electric Co. in recognition of outstanding contributions made during 1941 toward the progress of the company and the electrical arts. Of those who received awards, seventeen were engineers, four were shop workmen, six were tool designers and expert mechanics, two were administrative and clerical employes, and two construction engineers. Several of the awards were made for ideas that contributed directly to the acceleration of war material manufacture.

* * *

New Insulating Varnish

A new insulating varnish capable of withstanding high temperatures, especially developed to meet coil insulation requirements of generators, has been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This varnish is a synthetic resin type known by the trade name "Thermoset." It sets to an infusible, flexible, inert film of clear amber color, and is high in dielectric and bonding strengths.

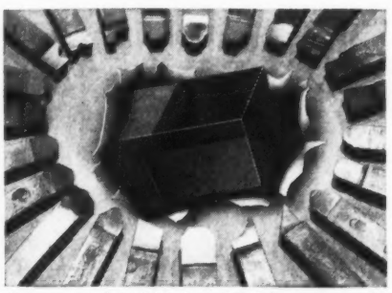
USE THIS METHOD TO GRIND CARBOLOY TOOLS QUICKLY—EASILY—EFFICIENTLY

Correct grinding of Carboloy tools is important! A poor grind wastes carbides, delays vital production and increases costs. A good grind provides long, trouble-free life between tool changes, conserves tools and speeds production.

When established procedure is followed, Carboloy tools can be ground quickly, efficiently and just as easily as ordinary tools. Below are a few of the more important points to observe. Detailed instructions are available upon request. These are contained in a 32-page manual on Carboloy tool design, application, brazing and maintenance.

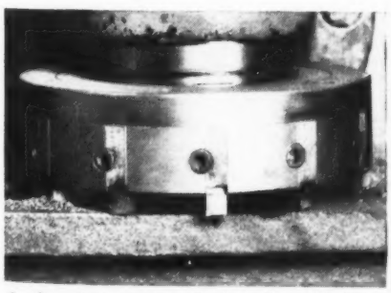
Use Standard Tools for Economy, Flexibility and Prompt Delivery

Carboloy Standard-Stock tools are available in 10 styles, a wide range of sizes and in general purpose grades for steel, cast iron, non-ferrous metals and non-metallics. They are adaptable to 80% of all turning, facing and boring jobs.



One user makes 200 "Specials" from one style of Standard

Many users maintain a stock of these standards in their tool crib and quickly grind to special shapes as required, ready for the job usually in less than one hour. One user (see cut) quickly adapts 200 special shapes from one style of Carboloy standard tool. Another (see cut) uses these standard tools as blades in face mills.



Another plant uses Standard Tools as blades in face mill

For a short cut to speed up—use Carboloy Standard Tools. Catalog GT-140.

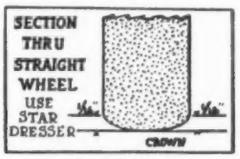
1. Use Correct Grinding Wheels

Use only the soft silicon carbide wheels recommended by wheel manufacturers or your carbide tool supplier. The following wheels are recommended for grinding single-point straight shank Carboloy tools:

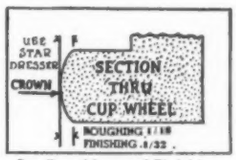
	Wheel Specifications	
	Carborundum	Norton
ROUGHING		
Silicon Carbide Wheels (Not recommended in sizes less than 10" dia.)	G-60-R-W	3960/1 I 7
Diamond Wheels (For Carboloy Tip)	100	100
FINISHING		
Silicon Carbide Wheels (Cup)	G-100-S-W	39100/1 H+7
LAPPING		
Diamond Wheels	240 Grit	220 Grit

2. Dress Wheels for Rapid Stock Removal

Correct dressing of wheels is important in safely obtaining rapid stock removal. Method shown enables you to keep area of contact against tool at a MINIMUM—avoiding generation of excessive localized heat—an absolute essential when grinding safely and rapidly.



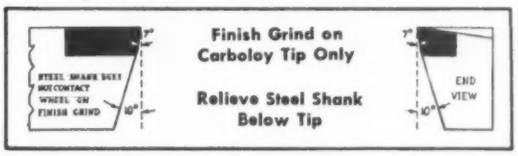
For Roughing



For Roughing and Finishing

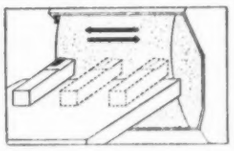
3. Use Double Angles to Insure Good Finish

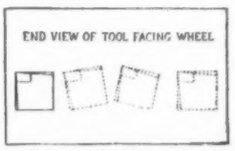
When rough grinding, ALWAYS grind side and front relief angles 2° to 5° greater than finished angle desired. By this you avoid grinding on the steel shank when finish grinding. Steel loads wheel rapidly—prevents you from obtaining best possible cutting edge (Use regular abrasive wheel for grinding steel.)


STEEL SHANK DOES NOT CONTACT WHEEL ON FINISH GRIND
Finish Grind on Carboloy Tip Only
Relieve Steel Shank Below Tip
END VIEW

4. Important! Keep Tool Constantly Moving

The following movements prevent excessive localized heating in the Carboloy tip and assure uniform wheel wear: Keep tool moving back and forth across wheel at all times while roughing, finish grinding and lapping. Keep tool ROCKING during roughing and finishing, as shown.

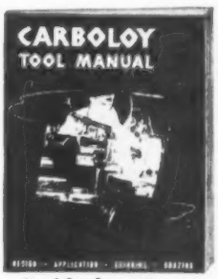




General Hints

If top face needs grinding, always grind it first. Then grind: (1) Front relief; (2) side relief; (3) radius. Complete each cycle for roughing, finishing, lapping.

Use rigid, carbide tool grinders equipped with adjustable table rests and graduated dial to obtain correct angles.



Send for free 32-page general tool manual

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TOOLS - DIES - DRESSERS
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NEWS OF THE INDUSTRY

California

GROVE REGULATOR CO., Oakland, Calif., has received the Navy "E" award for excellence in the production of naval material. Formal presentation of the pennant to the company and Navy "E" pins to the workers was made by Rear Admiral John W. Greenslade, Commandant of the Twelfth Naval District.

Connecticut

FRANK U. HAYES has been appointed assistant sales manager of the Bullard Co., Bridgeport, Conn., manufacturer of Mult-Au-Matics and vertical turret lathes. Last year Mr. Hayes served as technical adviser in the Tool Section of the Production Division of the OPM, and upon his return to the Bullard Co. established the firm's subcontracting division.

FRED E. LACEY has been elected president of the Lacey Mfg. Co., Inc., 715 Union Ave., Bridgeport, Conn., to succeed the late Franklin G. Hubbard. Mr. Lacey, who was formerly secretary and treasurer, retains the position of treasurer, but is replaced as secretary by S. W. LASTO.

Illinois

FRED S. DORAN has been elected vice-president of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Doran started with the company in 1905 as an office boy. Later he entered the sales department, and in 1920 became assistant sales manager. In 1927, he was appointed manager of the Ryerson Cleveland Steel Service plant, and last October was transferred to the general offices of the company in Chicago to assume direction of purchases for all ten Ryerson plants.

HOWARD W. BROECKER has been appointed assistant district manager of the Copperweld Steel Co. in the Chicago district, in charge of sales of Aristoloy alloy and Coppco tool steels. He was previously connected with the Youngstown Sheet and Tube Co., and with the Interstate Iron and Steel Co. in the Chicago district.

MAJOR JOHN SLEZAK, who is on leave of absence from his position as president of the Turner Brass Works, Sycamore, Ill., having joined the staff of the Chicago Ordnance District last January, has been made chief of the Tank and Combat Vehicles Division of the Chicago Ordnance District.

W. D. BRONSON has been appointed district manager of the Chicago area for the Carboloy Company, Inc., Detroit, Mich. Mr. Bronson, formerly assistant manager in Chicago, succeeds W. W. FULLAGAR, who has resigned.

MCCLURE KELLEY, formerly vice-president and treasurer of the Western-Austin Co., Aurora, Ill., has been elected president of the company, succeeding S. F. BEATTY, who has become chairman of the executive committee.

Michigan and Wisconsin

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the HARTLEY WIRE DIE CO., Thomaston, Conn., eastern manufacturing unit for the production and servicing of all types of Carboloy wire drawing, eyelet, ammunition, and bolt-sizing dies, shape dies, etc. Under the new arrangement the Thomaston plant, with a few exceptions, will operate exclusively in a manufacturing capacity, supplementing the main Carboloy plant in Detroit. Simultaneously, the eastern die servicing facilities, formerly located at Worcester, Mass., have been moved to the Thomaston plant, where they will operate as a Carboloy Company die service branch.

ARTHUR H. LOSEY has recently been added to the staff of the Automatic Polishing and Buffing Division of Hammond Machinery Builders, Inc., Kalamazoo, Mich. For the last six years, Mr. Losey has been associated with the J. C. Miller Co., Grand Rapids, Mich., in the capacity of engineer and adviser on polishing and buffing problems.

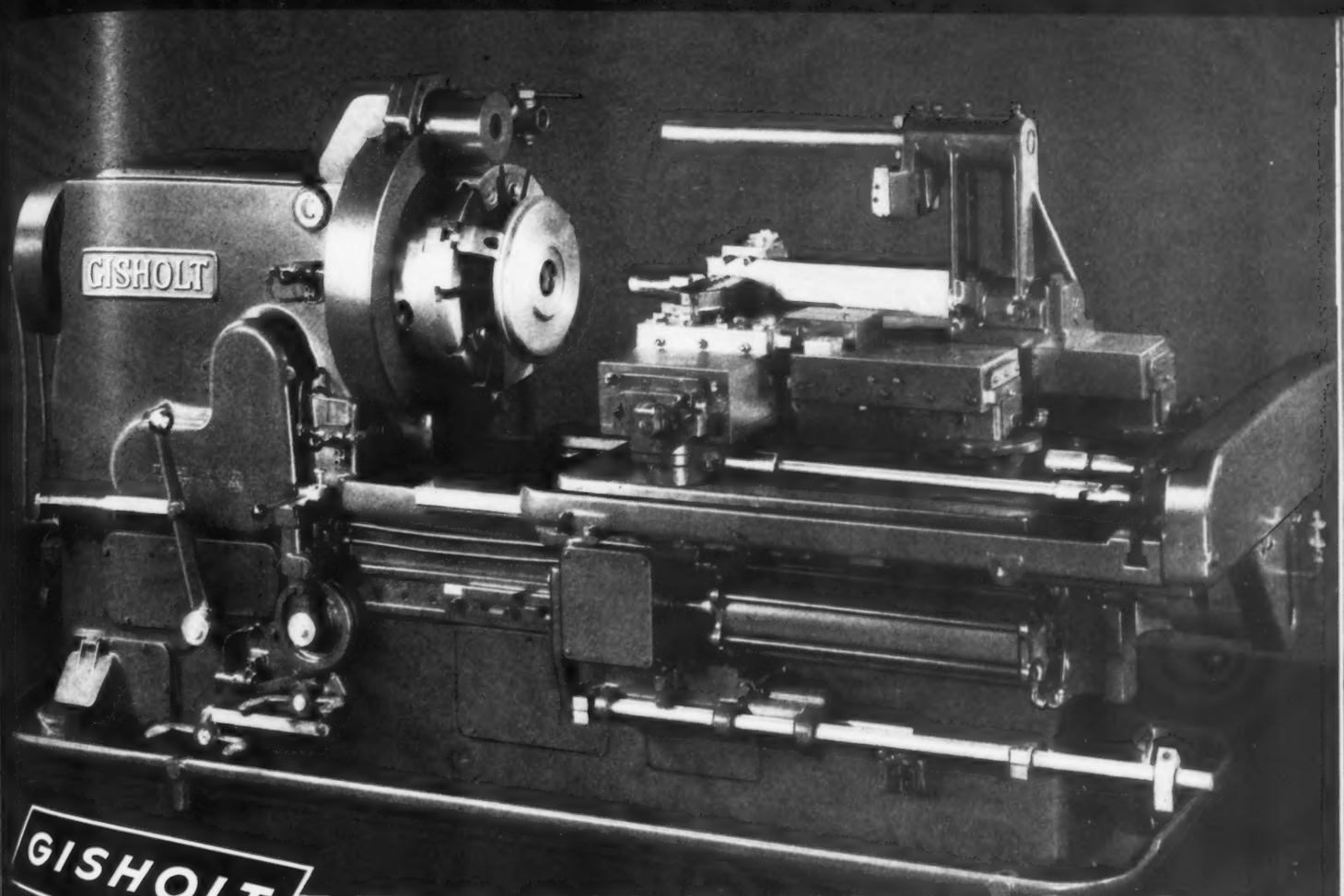
W. C. BUCHANAN has resigned as president of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., because of illness. He will retain his membership on the board of directors and executive committee of the company. WALTER GEIST, formerly vice-president, will succeed him as president. Mr. Geist entered the employ of the company as an errand boy in 1909 at the age of sixteen. He was steadily advanced through various positions until, when he was thirty-one, he became engineer in charge of transmission. During that period he was responsible for the development of the multiple V-belt drive, since known as the Texrope V-belt drive, for which he was awarded the "Plaque of a Modern Pioneer" by a committee of scientists headed by Dr. Karl T. Compton, president of the Massachusetts Institute of Technology.

New York and New Jersey

DR. FRANK J. TONE has retired as president of the Carborundum Co., Niagara Falls, N. Y., and was elected chairman of the board of directors at a recent meeting of the board. The new president is ARTHUR A. BATTS, who has been secretary of the company since 1927. CHARLES KNUPFER, formerly vice-president in charge of sales, and a member of the board of directors, was made senior vice-president, and will continue as head of the sales department. HENRY P. KIRCHNER has been made executive vice-president in charge of operations, having previously served as vice-president in the same capacity for a number of years. Mr. Kirchner also becomes a member of the board of directors. F. JEROME TONE, JR., has been elected to the board, and has been named a vice-president. EDWARD R. NEWCOMB has also been elected one of the vice-presidents. FRANK H. MANLEY, SR., who has been connected with the company since 1896, retires as treasurer.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York City, announces that its New Bedford Division and its Rome Division have both been awarded the Navy "E" pennant for excellence in production of vital war materials for the United States Navy. In both cases, the award was made by Rear Admiral H. A. Wiley, U.S.N. (Retired), representing the Secretary of the Navy, and was accepted by C. Donald Dallas, president of the company. Edward H. R. Revere, great-grandson of Paul Revere, founder of the company (the 167th anniversary of whose historic ride was just celebrated), read the Victory Pledge to the workers at the end of the ceremony at the New Bedford plant. The employes were presented with Navy "E" lapel buttons.

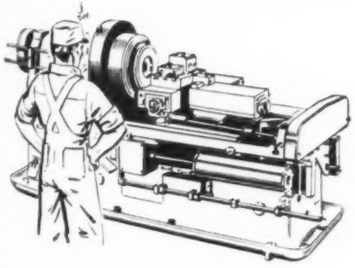
CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City, announces that the Pittsburgh offices of the company have been merged with the offices in Cleveland and Detroit, in order to better administer the steel requirements of those areas. The Cleveland office, located at 1258-74 E. 55th St., will continue under the management of FRANK E. PHELPS, and the Detroit office, located at 3245 Hubbard Ave., will be under the management of WILLIAM G. HASSEL, formerly manager



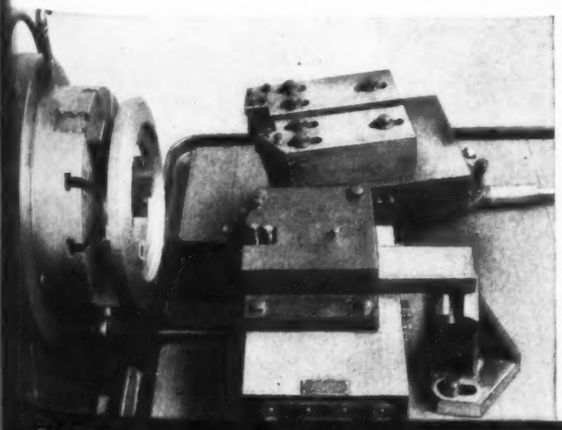
GISHOLT

SIMPLIMATICS

for large volume machining



The typical simplimatic tool setup shown below is for machining steel forged bevel drive gears for trucks.



PRODUCTION really *flows* with Gisholt Simplimatics! With all functions entirely automatic, speed and precision are combined to relieve demands on man power. One man can tend several machines. Skilled hands can be released for other important work. Less supervision is required.

Here, also, is flexibility. With a wide selection of independent and automatic feeds for slide tools, automatic retraction of slides and platen; and automatic spindle-stopping at the end of the cycle, the Simplimatic can be tooled to handle almost any type of cylindrical part.

If, during the defense effort, or afterwards, you can benefit with greater speed, this is the time to inform yourself about Gisholt Simplimatics. Gisholt Machine Company, 1209 Washington Ave., Madison, Wisconsin.

Look Ahead—
Keep Ahead—
With Gisholt
Improvements

GISHOLT

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

of the Pittsburgh office. C. J. RYAN will be assistant manager of the Detroit office.

JOHN F. DIEHL has opened a warehouse at 210 E. 34th St., New York City, where a stock of all types and sizes of De-Sta-Co toggle clamps will be carried. Mr. Diehl is eastern sales representative of the Detroit Stamping Co., Detroit, Mich., manufacturer of these clamps, and it is believed that the opening of a warehouse in New York will materially reduce the delivery time in the eastern territory.

HENRY PRENTISS & CO., INC., 405 Lexington Ave., New York City, well-known machine tool dealers, announce their retirement from active business. This company was established in 1875, and has represented a large number of the leading machine tool manufacturers in the United States for many years.

ARTHUR H. SCHAUER has resigned his position as sales engineer with the Westinghouse Electric & Mfg. Co. at Buffalo, N. Y., to join the sales and service force of the George Keller Machinery Co., 1807 Elmwood Ave., Buffalo.

HARKNESS W. CRAM, sales manager of the Aircraft Screw Products Co., Inc., 47-23 Thirty-fifth St., Long Island City, N. Y., has been elected vice-president in charge of sales.

MAGNUS CHEMICAL CO., INC., Garwood, N. J., manufacturer of cleaning materials, emulsifying agents, and metal-working lubricants, announces the following new appointments to its sales and service staff: WILLIAM D. WEST, sales representative in western South Carolina, with headquarters in Greenville, S. C., and EDWIN M. TAIT, sales representative covering Minnesota and South Dakota, with headquarters at Minneapolis, Minn.

It is also announced that the company has organized a machine division for the manufacture of mechanical metal-washing machines, pickling machines, dryers, ovens, and burnishing equipment. In addition, the company makes cleaning materials, emulsifying agents, and lubricants.

Ohio

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, manufacturer of milling, broaching and cutter sharpening machines, and CINCINNATI GRINDERS INCORPORATED, manufacturer of grinding and lapping machines, are now (effective June 1) serving their customers in New York State and New England through their sales subsidiary, CINCINNATI MILLING AND GRINDING MACHINES, INC., with district offices located in New York, Hartford, Boston, Buffalo, and Syracuse. A staff of field engineers, service men, and demonstrators, long technically trained and thoroughly experienced in milling, broaching, cutter sharpening, grinding, and lapping methods, will provide prompt and effective service to the manufacturing industries in these areas. HENRY PRENTISS & CO., INC., who have acted as the companies' exclusive dealer in New York State and New England since 1887, have announced their retirement from active business.

A. F. BOUCHER, district manager of the Detroit office of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment, has been called to active duty in his capacity as a reserve officer, and will be attached to the Ordnance Department. Mr. Boucher's position will be filled by C. H. BUCKMASTER, of the company's Pittsburgh office, and J. H. CUNNINGHAM, of the Detroit office, will take Mr. Buckmaster's place at the Pittsburgh office. The company also announces that GEORGE BAIN is being transferred from the Detroit to the Saginaw area.

E. M. KROPP and PETER ROBERTSON have been promoted to the position of assistant chief industrial engineer of the Republic Steel Corporation, Cleveland, Ohio. Mr. Kropp will handle management studies and general industrial engineering problems. Mr. Robertson will continue to work on manufacturing problems and plant lay-outs.

JOHN P. BERNARD, vice-president and assistant general manager of the Sheffield Corporation, Dayton, Ohio, and formerly vice-president in charge of operations of Dyer Engineers, Inc., Cleveland, Ohio, has been appointed a director of the Sheffield Corporation.

John P. Bernard, Newly Appointed Director of the Sheffield Corporation

ALBERT H. GRAF, JR., has been made sales engineer in charge of southern territory development of the Tocco process of electrical induction by the Ohio Crankshaft Co., Cleveland, Ohio. Mr. Graf's headquarters will be at 819 Drewry St., N. E., Atlanta, Ga. He has been connected with the main office of the company in Cleveland since 1941, following his return from France, where for many years he served as sales manager of the Electric Furnace Co. He was also associated for many years with Paul Heroult, inventor of the Heroult arc furnace.

N. H. BRODELL has been appointed metallurgical sales engineer of the Copperweld Steel Co., Warren, Ohio. Mr. Brodell was previously connected with the Steel and Tube Division of the Timken Roller Bearing Co., the Pittsburgh Crucible Steel Corporation, and the United Alloy Corporation.

W. R. KUHN has been appointed district manager of the Cleveland office of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Kuhn has been connected with the company and its subsidiaries since 1915, except for two years, during which he served in the first World War.

EDWARD NOE, formerly of the patent law firm of Marechal & Noe, has been made secretary of the Sheffield Corporation, Dayton, Ohio, manufacturer of precision gages and instruments. Mr. Noe has handled the patent problems of the Sheffield Corporation for many years, and in his new position will continue this work.

Pennsylvania

HENDLEY N. BLACKMON, manager of editorial service, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been awarded the Westinghouse Order of Merit for his "outstanding ability to interpret Westinghouse engineering achievements to editors of technical and trade magazines, and for his honesty of opinions." G. EDWARD PENDRAY, assistant to the president of the Westinghouse Electric & Mfg. Co., in charge of publicity and advertising, and JAMES BOYD, eastern district manager, have also received the Westinghouse Order of Merit.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., announces the election of four new vice-presidents, namely, ANDREW H. PHELPS, manager of purchases and traffic; L. E. OSBORNE, manager of the steam division; FRANK C. REED, president of the West-

Better Guns · More Guns · *Faster!*

SUNICUT NEARLY DOUBLES PRODUCTION

Increases Tool Life 60%

Guns and more guns is the aim of America today — produce better guns . . . more guns . . . faster! That's exactly what one munitions manufacturer achieved when he called in a Sun Oil Engineer . . . one of those Doctors of Industry.

A change was made to Sunicut, the free-flowing, transparent sulphurized cutting oil, on machines producing parts for anti-aircraft guns. The improvement was noticeable almost immediately. Tool life increased 60% . . . finish was improved . . . and the output of vitally needed parts boosted from 2½ pieces per eight hour shift to almost 4½ . . . nearly doubling production.

That's another typical example of how Sunicut and Sun Oil Engineers are helping America step up production for victory!

Throughout the war industries . . . wherever metal cutting problems arise . . . *Sun's Doctors of Industry* and this extraordinary cutting oil stand ready, willing and able to help. Call on them to improve production in your plant. For helpful case histories of what they have accomplished in other leading metal working plants, write for your free copy of "Helping Industry Help America."

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SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA

inghouse Electric Elevator Co.; and WALTER C. EVANS, general manager of the radio, X-ray, and broadcasting divisions.

ROBERT M. ZACHARIAS, formerly of Church & Church, patent attorneys of Washington, D. C., has recently become associated with the McKenna Metals Co., Latrobe, Pa., manufacturer of Kennametal steel-cutting carbide tools and tool blanks. He is stationed at the main office to assist in the expansion program of this concern.

J. C. MCQUISTON has resigned as secretary-manager of the American Gear Manufacturers Association, after

J. C. McQuiston, for Ten Years Secretary-Manager of the AGMA

Newbold C. Goin, New Secretary-Manager of the AGMA

serving ten years in that position. NEWBOLD C. GOIN, formerly sales manager of the Gearing Division of the Nuttall Works of the Westinghouse Electric & Mfg. Co., succeeds Mr. McQuiston. Mr. McQuiston has long been identified with the gear industry. Prior to his official connection with the American Gear Manufacturers Association, he was for more than thirty years general advertising manager of the Westinghouse organization. It was during his connection with Westinghouse that Mr. McQuiston participated in the founding of the American Gear Manufacturers Association in 1917.

DAVID W. JENKINS, general sales manager of Henry Disston & Sons, Inc., Philadelphia, Pa., has retired after forty-six years of service with the company. Mr. Jenkins joined the company on December 26, 1896. He established the first company branch on the Pacific coast in 1909.

E. F. HOUGHTON & Co., Philadelphia, Pa., announces that the retail sales division of the LUBRI-ZOL CORPORATION, Cleveland, Ohio, has assigned its interests to the Houghton organization, which henceforth will manufacture, sell, and service Lubri-Zol lubricants.

W. A. GIVENS has been elected to the newly created position of executive vice-president of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. FRANK B. LOUNSBERRY succeeds Mr. Givens as vice-president in charge of manufacturing.

WYCKOFF DRAWN STEEL CO., Pittsburgh, Pa., has received the All-Navy "E" Burgee—the top Navy Award for outstanding achievement in production. The company has previously been awarded the Navy "E" pennant.

W. J. ADAMSON, formerly manager of carbon steel sales for the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., has been made manager of the newly created flat-rolled products department.

H. E. DOUGHTY has been appointed assistant sales manager of the Jessop Steel Co., Washington, Pa. He was formerly district manager for the company at Philadelphia.

* * *

Gear Production Continues to Increase

Gear production in the four months ending with April, this year, was 34 per cent above the corresponding period of 1941. This applies only to industrial gears; it does not include automotive gears or gears used in high-speed turbine drives.

COMING EVENTS

JUNE 8-10—Meeting of the AMERICAN ELECTROPLATERS' SOCIETY at Grand Rapids, Mich., with headquarters at the Pantlind Hotel.

JUNE 8-10—Semi-annual meeting of AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Statler, Cleveland, Ohio. Secretary, C. E. Davies, 29 W. 39th St., New York City.

JUNE 20—Fifteenth semi-annual meeting of the EASTERN PHOTO-ELASTICITY CONFERENCE at the University Club, 40 Trinity Place, Boston, Mass. For further information, address W. M. Murray, Room 1-321, Massachusetts Institute of Technology, Cambridge, Mass.

JUNE 22-26—Forty-fifth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

OCTOBER 12-16—NATIONAL METAL CONGRESS AND EXPOSITION in Cleveland, sponsored by the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland.

NOVEMBER 17-22—NATIONAL CHEMICAL EXPOSITION AND INDUSTRIAL CHEMICAL CONFERENCE at the Stevens Hotel, Chicago, Ill. For further information, address National Chemical Exposition, 110 N. Franklin St., Chicago, Ill.

NOVEMBER 30-DECEMBER 3—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Astor, New York City. Secretary, C. E. Davies, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 5—Fifteenth NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

* * *

You cannot share in the management of a business unless you are willing to share in the responsibilities also. This involves sharing in the losses during periods when a business is not profitable. Are those labor leaders who wish to share in business management prepared to accept the responsibilities and the possible losses as well?

"FIGHTING" Speeds FOR PRODUCTION MACHINES

This shell cleaning machine, built by American Foundry Equipment Co., Mishawaka, Indiana, has "fighting" speeds because it is equipped with a REEVES Vari-Speed Motor Pulley for fast speed changes.

There isn't much "fight" in a machine that can't change speeds when the need comes. Stodgy, stolid, unresponsive, it just "plugs along"—incapable of being speeded up or slowed down to meet any changed condition.

But give the same machine the complete flexibility—the ability to change pace easily and quickly which comes with REEVES Variable Speed Drives, and watch production zoom!

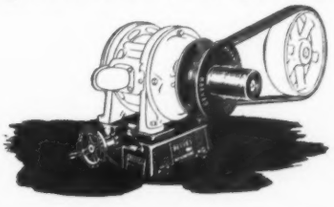
Then work flows smoothly from one machine to another, with speeds synchronized to avoid delays. Each machine operates at the very best speed for the particular job or process, to prevent waste and spoilage. As slow as is necessary for "green hands." As fast as skilled workers can keep up. Faster or slower—but always the best speed—the most efficient speed—as work in process changes size, shape or periphery.

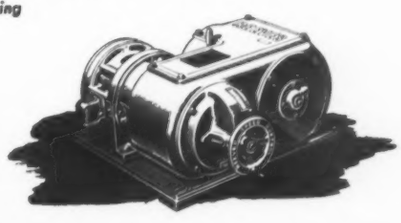
These are the advantages of variable speed control that put more "fight" in any machine. They are the advantages best exemplified in the *infinite speed adjustability, accurate speed setting and positive operation* of REEVES *Variable Speed Drives.*

If you are building a machine that is essential to our war program, write, wire or phone us. We shall do our best to supply you. Send for copy of Catalog-Manual M-419.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Field of Speed Control Engineering





OBITUARIES

George A. Decker

George A. Decker, a director of the Warner & Swasey Co., Cleveland, Ohio, and works engineer for twenty-five years before he retired in 1940, died on May 13 at the age of seventy-seven years. Mr. Decker was born in Columbus, Ohio. In 1870, his father, a cooper, moved to Cleveland with his family to make barrels for John D. Rockefeller, who was starting in the oil business.

George A. Decker

In 1882, Mr. Decker became an apprentice for the Warner & Swasey Co. At that time, the standard wage for machinist apprentices was four cents an hour, but Mr. Decker soon attained a higher wage level. His aptitude gained him appointment as foreman of the lathe department before he had finished his four-year apprenticeship. He later became assistant superintendent of the company and then superintendent. He was made works manager in 1915.

At the time of his death, Mr. Decker was the oldest employe of the Warner & Swasey Co. In his years of employment there he erected and installed several telescopes and revolving domes. He was considered a specialist on the installation of revolving domes.

ROBERT F. VOGT, chief consulting engineer of the Allis-Chalmers Mfg. Co. since 1937 and an employe of the company for thirty-six years, died on April 17 after a week's illness, at the age of sixty-two. Mr. Vogt's professional career began in the United States about forty years ago, when he came here from Switzerland, where he was born. He was a graduate of the Swiss Polytechnicum at Zurich. He joined the Allis-Chalmers organization in 1907 as a mechanical engineer.

After years of experience in design and development work in various departments, Mr. Vogt was appointed assistant chief consulting engineer in 1921. In 1937 he succeeded J. F. Max Patitz as the company's chief consulting engineer. Mr. Vogt is survived by his wife and a son. He was a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers.

JOHN C. WATTLEWORTH, vice-president of the Cleveland Automatic Machine Co., Cleveland, Ohio, died on April 19 at the Lakewood Hospital in Cleveland, a short time after being stricken by a cerebral hemorrhage while driving his automobile. He was forty-eight years old. Mr. Wattleworth was born in Cleveland, and graduated from the Case School of Applied Science in 1920 with the degree of Bachelor of Mechanical Engineering. Soon after graduating, he became a teacher of mechanical engineering at the Case School, in which position he continued until 1932, when he joined the Vlchek Tool Co. in the capacity of general manager. In 1936, he became connected with the Cleveland Automatic Machine Co. For five years he had been a member of the Cleveland Heights Board of Education. He is survived by his wife and two daughters.

MORRIS S. TOWSON, president and general manager of the Elwell-Parker Electric Co., Cleveland, Ohio, died in Orlando, Fla., on March 17 at the age of seventy-six years. Mr. Towson was born in Cleveland, Ohio, and was graduated from the Case School of Applied Science in 1886. For several years he was associated with the Brown Hoisting Machinery Co. of Cleveland. In 1893, a separate company was organized by that concern to build the Elwell-Parker motor under British license, and Mr. Towson was placed in charge.

Mr. Towson was considered the father of the power truck industry, the commercial development of which began in 1906. He developed and patented many basic features incorporated in power industrial trucks.

ALLISON SHARP, vice-president and treasurer of the Wicaco Machine Corporation, Philadelphia, Pa., died on May 3.

FRANKLIN G. HUBBARD, president of the Lacey Mfg. Co., Inc., of Bridgeport, Conn., died on April 2.

Production for Victory Conference

The American Management Association held a meeting May 13 and 14 at the Hotel Astor, New York City, to give engineers an opportunity to exchange wartime production experiences and ideas. The six key factors in the "Production Battle," which formed the topic of the meeting, were organization, hiring new employes, making equipment last, obtaining full worker cooperation, efficient production control, and the building up of plant enthusiasm.

The speakers at the meeting emphasized that sound organization and planning are the keys to coordinated manufacture. It was pointed out that faulty organization has been the cause of delays in sub-contracting operations, and that it has slowed down the work of many prime contractors

In dealing with the subject of new employes, reference was made to the fact that industry requires new workers not only because it is expanding its manufacturing capacity, but because it is losing workers to the armed forces. The speakers showed where replacements are coming from, and, among other topics, dealt with how women workers entering industry are trained.

Questions pertaining to the maintenance of equipment were specifically dealt with. New machines will become increasingly difficult to obtain. It was pointed out how proper maintenance can keep machines in operation a maximum number of hours per week.

On the subject of production control, such questions as these were answered: How can proper planning and scheduling be insured when production is suddenly stepped up? What quality control measures are necessary for three-shift operating conditions? How can employes be encouraged to handle tools more carefully? What are the best methods of stores control? What is being done about salvage? How can planning help avoid material shortages?

On the subjects of obtaining worker cooperation and plant enthusiasm, many suggestions were made. What companies are doing to build morale and increase production was explained, and several speakers referred to the devices that have been found effective for this purpose. In this connection, there was a display of posters, bulletin boards, etc., that are being made use of in munition plants with this end in view.

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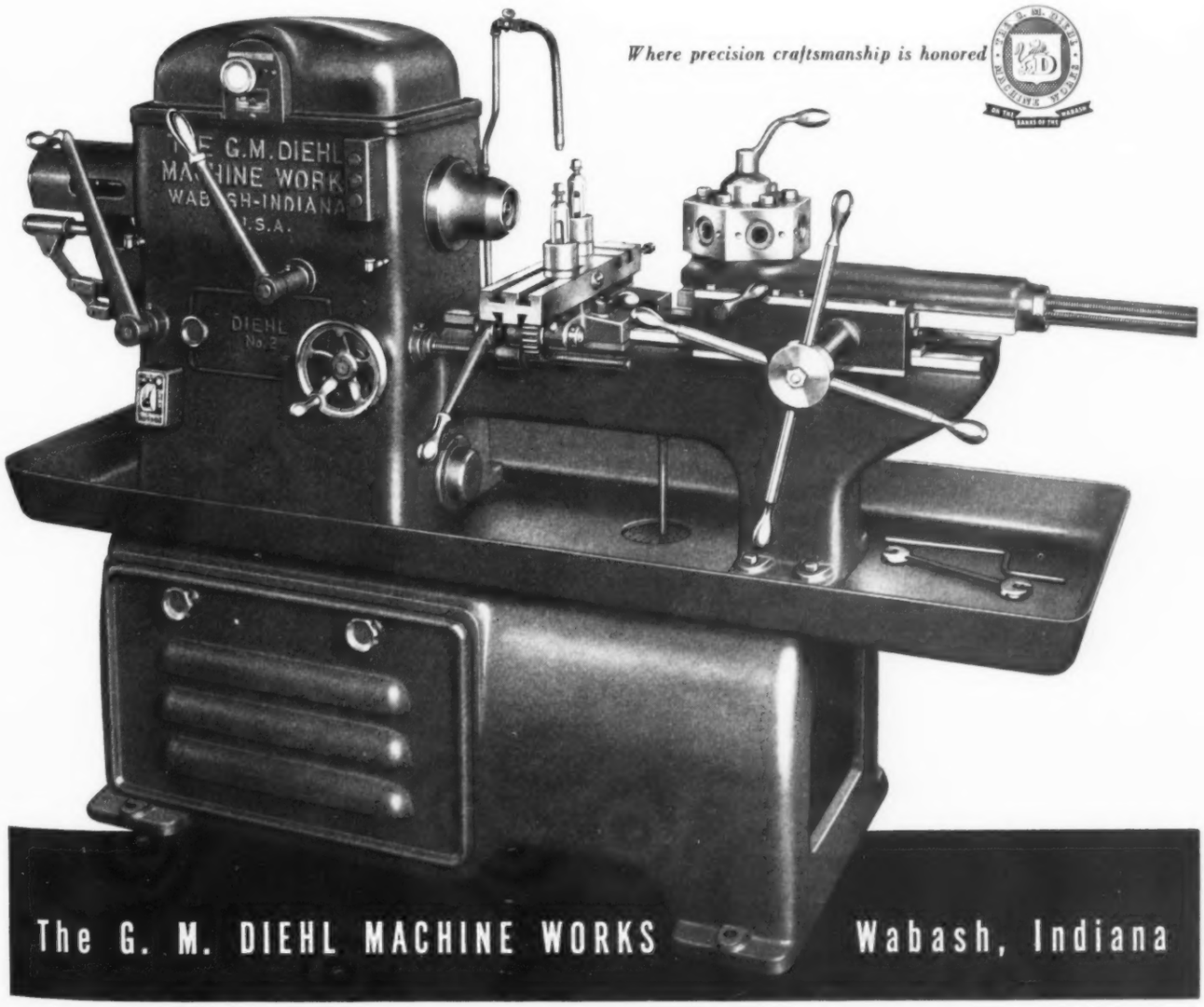

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NEW BOOKS AND PUBLICATIONS

DUNWOODY LATHE JOB TRAINING UNIT. 143 pages, 8 1/2 by 10 3/4 inches. Published by the American Technical Society, 58th at Drexel Ave., Chicago, Ill. Price, $1.35.

This is one of a series of Machine Shop Training manuals, the object of which is to train the student to operate different machine tools. Each book contains a certain number of specific jobs to be performed on the machine in question. For each job there is an instruction sheet covering the job to be done; the materials, tools, and equipment required; general instructions; operating steps in the order in which they are taken; sketches; precautions to be taken for safety; and references to other sources of information. Questions are included to be answered after the job is finished, so as to test the student's understanding of the work.

The other manuals in the series and their prices are as follows: Bench Work (155 pages, $1.35); Shaper and Planer (115 pages, $1.25); Drill Press (103 pages, $1.25); Grinder (111 pages, $1.25); Milling Machine, (110 pages, $1.25).

In addition, there is an Instructor's Guide, applicable to all the different units, which furnishes helpful information regarding the use of the manuals; the organization and control of the training experience; and methods of instructions. The price of this book is 75 cents.

PRODUCTION ENGINEERING. By Earle Buckingham. 268 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.50.

This book has been written primarily as an engineering textbook. It covers the relationship of the technical problems concerned with the product, the manufacturing processes, and the plant. In a comprehensive manner, it deals with all the important factors that enter into the production of an article. The best conception of the broad scope of the book can be given by listing the different subjects dealt with. The book takes up first production design, the planning of the equipment, tool design, and the "proving" of the production design and equipment. Then follows a section specifically on production, dealing with the selection, training, and direction of operators, quality control, and means for cost reduction. Other chapters of importance in rounding up the entire subject cover standardization, factory costs for the engineer, process development, and product development. The author, who is professor of mechanical engineering at the Massachusetts Institute of Technology, has an extensive background of manufacturing experience.

THE MATHEMATICS OF THE SHOPS. By Frank J. McMackin and John H. Shaver. 444 pages, 5 1/2 by 8 1/2 inches. Published by the D. Van Nostrand Co., 250 Fourth Ave., New York City. Price, $2.50.

The material in this book is intended for use in shop mathematics classes of vocational schools, evening trade extension classes, apprenticeship classes, and classes in the National Defense training program. It is also suitable for use in connection with certain shop activities of the junior and senior high schools. The text lays the groundwork for the application of mathematics to shop problems by explaining in simple language the fundamentals of arithmetic, algebra, geometry, and trigonometry. Emphasis is then given to basic problems arising in the building trades, the electrical shop, and the machine shop. Nearly 700 drawings and sketches are included, which give the student a wide experience in reading and interpreting the various types of drawings.

WAGE INCENTIVE METHODS. By Charles W. Lytle. 462 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $6.

This is a new edition of a book on the selection, installation, and operation of wage incentive systems. The text has been rearranged and new material added. The book opens with a new chapter on job evaluation. Following this, it discusses the problems an executive must face in selecting the best wage plan, classifies various plans, and describes them in detail, giving earning and cost curves with data for over two dozen specific plans. A chapter has been added on plans for accelerating premiums which have emerged in answer to the minimum wage requirements. Other chapters deal with group application; incentives supplementary to production; incentives for indirect production; incentives for office workers, supervisors and executives; and installation.

HOW YOUR BUSINESS CAN HELP WIN THE WAR. 111 pages, 8 1/4 by 10 3/4 inches. Published by Simon & Schuster, 1230 Sixth Ave., New York City. Price, $1.

This is a practical guide, with an introduction by Donald M. Nelson, chief of the War Production Board, designed to show business men how to help the Government meet total war needs by telling them: (1) What the Government wants to buy; how to bid; how to get contracts and subcontracts for Government orders; (2) how to save time and money and cut red tape in contacting Government offices. The material is so complete that it will be found an invaluable guide to business men in determining what to make, where to go, what kind of contract to negotiate and how to sub-contract war orders. It should be of especial help to the small business man who wishes to obtain war work, but does not know just how to go about it.

PLASTICS IN ENGINEERING. By J. Delmonte. 601 pages, 6 by 9 inches. Published by the Penton Publishing Co., Cleveland, Ohio. Price, $7.50.

Since the first edition of this book was published, less than two years ago, circumstances have greatly influenced the trends in the plastics industry. New materials, equipment, methods, and applications have been developed, and the war emergency, which has necessitated the withholding or curtailing of the use of strategic metals, has stimulated the application of plastics. The new edition has brought this book up to the minute, including descriptions of new materials, techniques, and ways of adapting plastics to design programs. In the present edition, extruded plastics and resin-bonded plywoods have been given much more prominence, because of the tremendous expansion that has taken place in these developments during the past year.

DIE DESIGNING AND ESTIMATING. 160 pages, 6 by 9 inches. Published by the American Industrial Publishers, 2460 Fairmount Blvd., Cleveland, Ohio. Price, $3.

Second edition of a book dealing with the design of dies and die estimating. The contents have been completely revised, and several new chapters have been added, two of which deal with progressive dies and drawing dies. The new edition includes an outline of equipment and operations for the manufacture of small arms cartridge cases. The material has been arranged for convenient reference by practical tool-room and die shop men, as well as students and apprentices. One of the special features of the new edition is the tables of time values. The section on die

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estimating has been amplified, and a separate index to tables of time values has been added.

WORK ROUTING, SCHEDULING, AND DISPATCHING IN PRODUCTION. By John Younger and Joseph Geschelin. 160 pages, 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $3.25.

This is a revised edition of a book covering the routing, scheduling, and dispatching of work. At this time when increased production is of such great importance the subject of planning work for production is of especial interest. It is evident that no production plan can be fully realized unless all of the operations are performed in the proper sequence, in the proper time, and at the lowest cost. The book has been written for two groups of readers—executives and others concerned with daily problems in industry, and students of industrial management and engineering in college classrooms.

HOW TO CREATE JOB ENTHUSIASM. By Carl Heyel. 248 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $2.

The object of this book is to point out that it is possible to instill in workers zest for their jobs and to explain how this can be done. The book develops a practical procedure for getting people to carry out satisfactorily and willingly the tasks allotted to them. It tells how to convince people that "what is worth doing is worth doing well." An idea of the contents of the book may be obtained from the chapter headings: What This Book is About; Is This Game Worth the Candle?; Manifestations of Job Enthusiasm; Five Things to Keep in Mind; "The Mail Must Go Through"; The "We" Attitude; Spontaneous Discipline; and Smiling and Cheerful on the Job.

DIMENSIONAL CONTROL. 64 pages, 7 3/4 by 10 5/8 inches; 82 illustrations. Published by the Sheffield Corporation, Dayton, Ohio. Price, $1.50.

This book on the use of gages in modern industry has been prepared to meet the need for technical literature on topics vital to the war effort in plants, engineering schools, and defense classes. It contains basic data on gages and gaging practice covering the following subjects: History of Standards and Gaging; Science of Measurement in Modern Industry; Fixed-Size Gages; Tolerances; "Go" and "Not Go" Gages; Thread Snap Gages; Assembly Practices and Non-Perishable Gages; The Visual Gage; The Electric Gage; The Multiple Gage; The Air Gage; Thread Lead Measurement; External Measurement; Internal Measurement; The Future of Precision Manufacture; and Fits and Tolerances.

HOW TO TRAIN SHOP WORKERS. By C. A. Prosser and Philip S. Van Wyck. 126 pages, 8 1/4 by 10 3/4 inches. Published by the American Technical Society, Chicago, Ill. Price, $1.25.

This shop training manual has been prepared for the purpose of helping shop foremen in training workers for any mechanical occupation and assisting shop instructors in day and evening schools. The material was originally published in a foreman training manual prepared by the National Youth Administration. It has been revised by Mr. Prosser, director of the William Hood Dunwoody Industrial Institute, Minneapolis, Minn., and is now issued in mimeographed form. The section included in the present publication deals primarily with the training of learners in efficient habits of work and workmanship.

BLUEPRINT READING, CHECKING, AND TESTING. By Otto A. Steinike. Published in two parts, Part I, 61 pages, 5 1/4 by 8 inches; Part II, 78 pages, 7 3/4 by 10 inches. Published by McKnight & McKnight, 109 W. Market St., Bloomington, Ill. Price, Part I $1.20; Part II 80 cents.

This new course in blueprint reading and checking is issued in two parts—Part I comprising the instruction book, and Part II reproductions of actual blueprints for interpretation. There are thirty-nine problems in all, ranging from simple drawings to complex ones. The student is taught to read both the pictorial and the working drawing for each problem.

HOW TO RUN A LATHE. 128 pages, 5 1/8 by 8 inches; over 365 illustrations. Published by the South Bend Lathe Works, South Bend, Ind. Price, 25 cents.

This is the forty-first edition of a book containing information on the operation and care of lathes, of special value for apprentice training courses. It covers such subjects as the operation of the lathe units, grinding cutter tips, making accurate measurements, plain turning, chuck work, taper turning, boring, drilling, reaming, cutting screw threads, etc.

SHOP THEORY. 267 pages, 8 1/4 by 10 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $1.25.

This is a revised edition of a book prepared by the shop theory department of the Henry Ford Trade School. It consists of mimeographed sheets prepared by the instructors and used in the classes of that school. The material comprises a course on general shop practice, covering the types of tools and machines used in machine shops.

THE BUCKLING OF COMPRESSED BARS BY TORSION AND FLEXURE. By J. N. Goodier. 32 pages, 6 by 9 inches. Published by the College of Engineering, Cornell University, Ithaca, N. Y., as Bulletin No. 27 of the Engineering Experiment Station. Price, 50 cents.

This bulletin presents a mathematical analysis of a type of buckling encountered in tests of aircraft components.

EIGHTH PROGRESS REPORT OF THE JOINT INVESTIGATION OF FISSURES IN RAILROAD RAILS. Conducted by the Engineering Experiment Station of the University of Illinois in Cooperation with the Association of American Railroads and the Rail Manufacturers Technical Committee. By Herbert F. Moore. 38 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill. Price, 15 cents.

A STUDY OF THE COLLAPSING PRESSURE OF THIN-WALLED CYLINDERS. By Rolland G. Sturm. 80 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin Series No. 329 of the Engineering Experiment Station. Price, 80 cents.

TRAINING OXY-ACETYLENE WELDING AND CUTTING OPERATORS—INSTRUCTORS' OUTLINES. 88 pages. Published by the International Acetylene Association, 30 E. 42nd St., New York City. Price, paper-bound, 25 cents; cloth-bound, 75 cents.

THE EFFECT OF RANGE OF STRESS ON THE FATIGUE STRENGTH OF METALS. By James O. Smith. 52 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin Series No. 334 of the Engineering Experiment Station. Price, 55 cents.

EXPORT CONTROL LIST. 32 pages, listing products with all licensing and destination symbols for each item. Published by the New York Journal of Commerce, 63 Park Row, New York City. Price, 10 cents.

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